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TECHNOLOGY DEPT.

ents, page 184

RUBBER WORLD

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BICATION

TIRES FOR TODAY'S CARS

By R. P. Dinsmore, page 249



Hard rubber products like this battery box account for the use of tons of Accelerator 808 each year.

Du Pont Accelerator 808

...the standard accelerator for hard rubber stocks

Battery boxes are just one example. Accelerator 808 is widely accepted as a basic accelerator for all types of hard rubber stocks. It assures a good cure as well as long-term aging, safe processing and minimum discoloration.

Use Accelerator 808 for moderate cure activity in natural rubber and SBR products like tire carcasses, mechanical goods, inner tubes, and shoe soles. In neoprene, it gives very fast cures if litharge is present. When vulcanized with Accelerator 808, stocks containing reclaimed rubber have a very rubbery, snappy feel and age exceptionally well.

Accelerator 808 is non-scorching at processing temperatures and is an excellent activator for acidic accelerators. It is liquid in form and can be dispersed readily in dry elastomers. Master batching is not necessary.

Contact the district office nearest you for more information about Du Pont Accelerator 808.

Du Pont Accelerator 808 is a butyraldehyde-aniline condensation product.

Write for booklet A-5737, a review of Du Pont's complete line of elastomers and rubber chemicals.

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Elastomer Chemicals Department, Wilmington 98, Delaware

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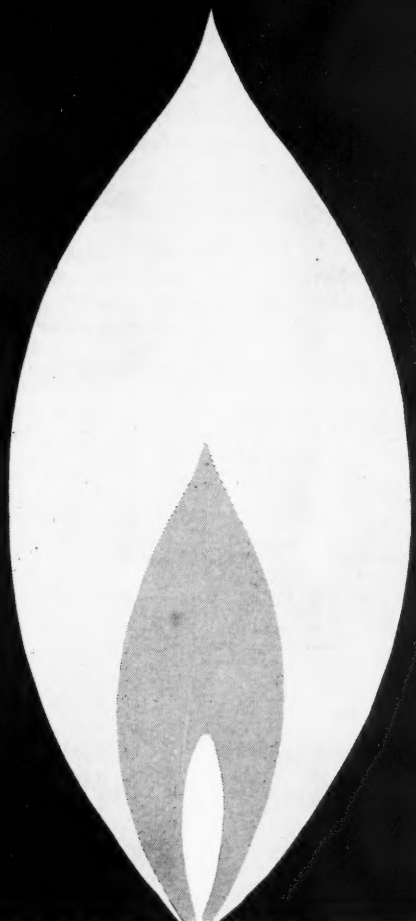
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News about

B.F. Goodrich Chemical *raw materials*

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TIRE-CAR PERFORMANCE RACE CONTINUES

How well the present-day tire has kept pace with the demands of today's more powerful cars and what tire designers are doing to meet new demands are detailed.

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Cover Photo: Courtesy of Goodyear Tire & Rubber Co.—A. Devaney, Inc., Photo
The opinions expressed by our contributors do not necessarily reflect those of our editors

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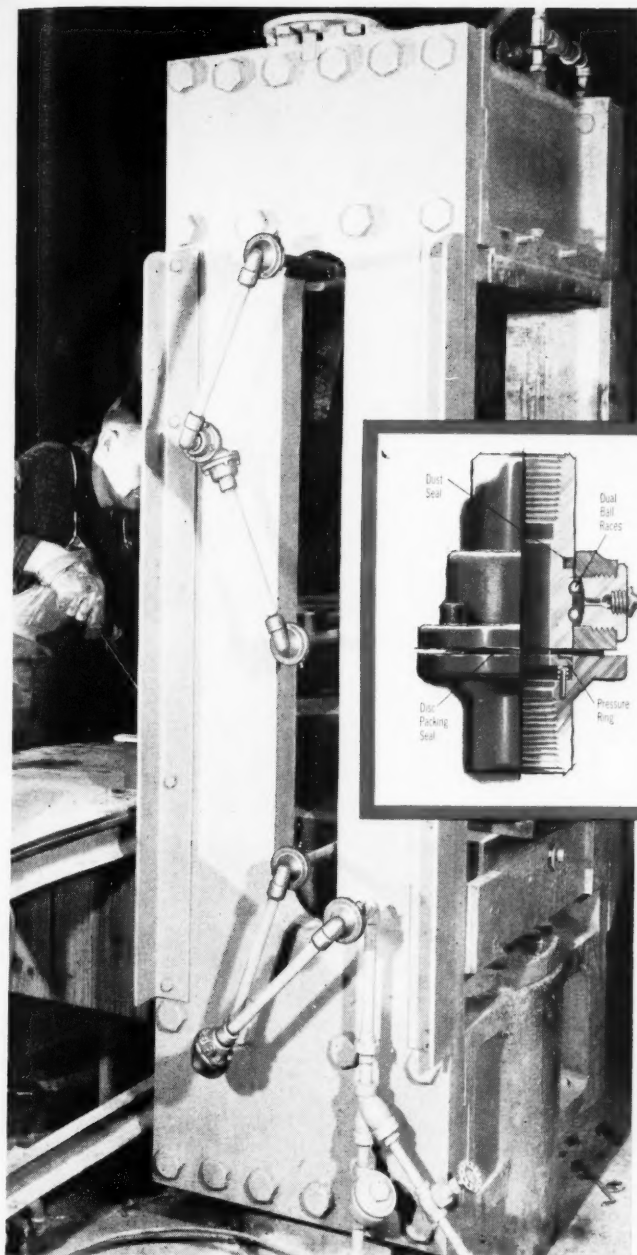
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Letters to the Editor

Re: Hoover Reports

BILL BROTHERS PUBLISHING CORP.
New York, N. Y.

GENTLEMEN:

We have been aware of the fine support your publications have been giving the Hoover Reports. You are doing some very effective work for a good cause, and your organization is to be congratulated.

EARL B. STEELE

Manager,
News and Information Dept.,
Chamber of Commerce of the U. S.,
Washington, D. C.

Re: Perforated Pages

DEAR SIR:

We should like to reply most favorably on the scored pages that you instituted in your magazine.

We sincerely hope that you will continue this practice.

R. L. SCHIFFMAN

United States Rubber International,
New York, N. Y.

DEAR SIR:

Perforated pages in the RUBBER WORLD magazine are an excellent idea. It means that I can remove selective articles without tearing the pages.

HENRY PETERS

Bell Telephone Laboratories,
Murray Hill, N. J.

DEAR SIR:

With reference to your question, in the recent issue of RUBBER WORLD, to perforate, or not to perforate, would advise that the writer is in favor of perforating the pages.

S. EVERETT PERLBERG

Adamson United Co.,
Hackensack, N. J.

DEAR SIR:

Yes, we like the perforated pages. Hope you will continue.

ROBERT ROBERTS

Roberts Toledo Rubber Co.,
Toledo, O.

Along with the many letters of approval regarding the practice of perforating the editorial pages of RUBBER WORLD, we have had a significant number of requests from librarians for copies without perforations for their bound volumes of our publication.

Beginning with this May issue, therefore, copies without perforations will be mailed to all libraries on our circulation list; while all other subscribers will receive copies with perforated pages, so that this extra service will be adjusted to the requirements of both types of subscribers.—EDITOR.

Note: This column is the place for readers to express opinions on subjects of interest to the rubber industry and RUBBER WORLD. Please let us hear from you at any time.—EDITOR.

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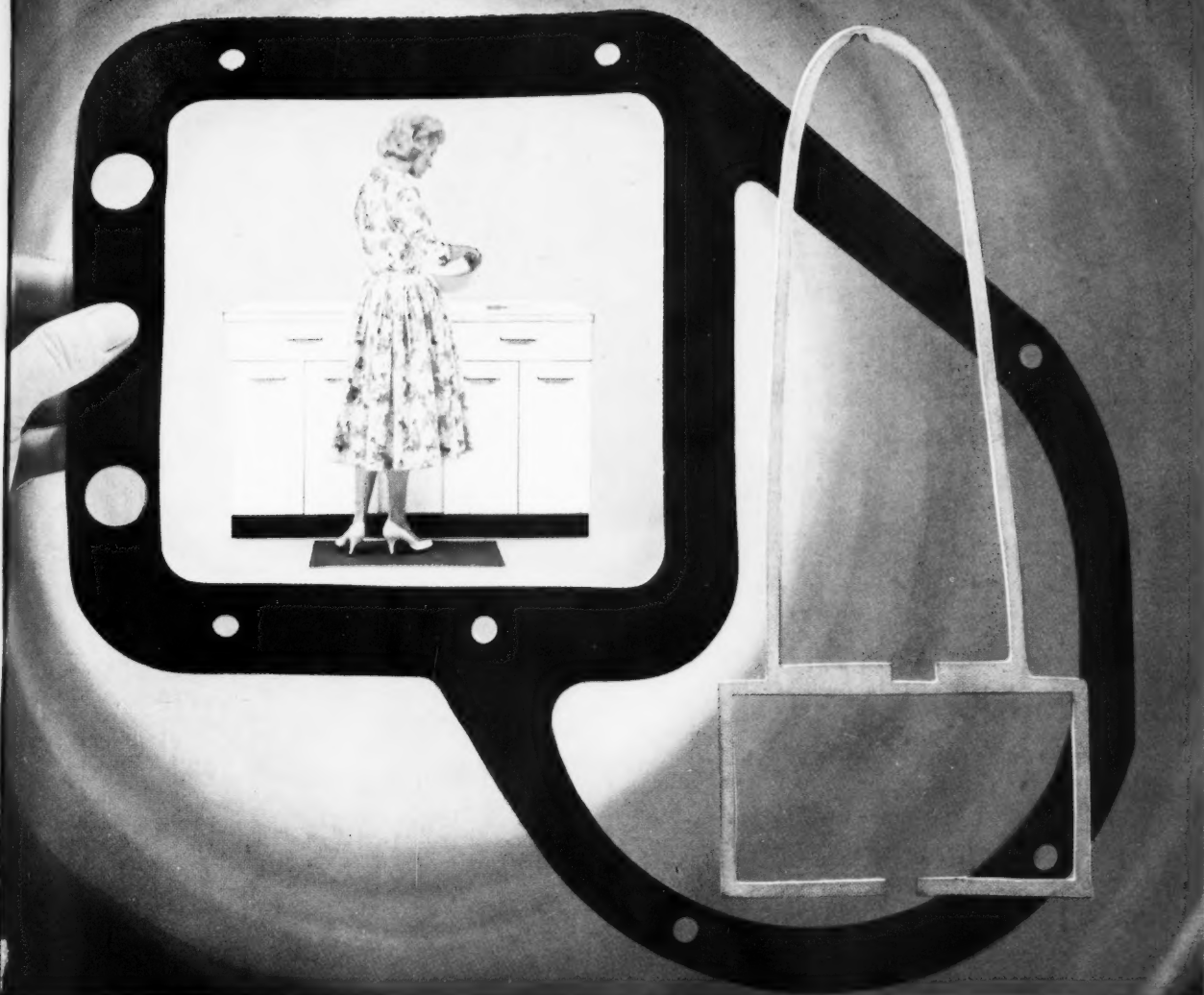


Photo courtesy Bearfoot Airway Corporation, Wadsworth, Ohio

Secret of a full-blown success

The inside story on the success of the rubber cushion rug and gaskets shown above lies in their internal structure. Through a carefully controlled chemical reaction, solid PLIOFLEX rubber is transformed into thousands of tiny, individual, uniform, nitrogen-filled bubbles. The end results are permanent resiliency and unusual durability that add up to outstanding cushioning and sealing.

It's not easy to produce a top-quality, chemically blown, closed cell sponge. Uniform plasticity and con-

sistently low moisture content of the base rubber are essential to obtaining just the right cell structure. And these properties, along with its light color that stays light, are the main reasons why PLIOFLEX is used.

If you're seeking success for any product that is, or could be, made of rubber, make sure you have the full story on PLIOFLEX. It's yours, along with complete technical assistance, simply by writing Goodyear, Chemical Division, Dept. Q-9418, Akron 16, Ohio.



GOOD YEAR

CHEMICAL DIVISION

CHEMIGUM • PLIOFLEX • PLIOLITE • PLIOVIC • WING-CHEMICALS

Chemigum, Plioflex, Pliolite, Pliovic-T, M.'s The Goodyear Tire & Rubber Company, Akron, Ohio





Photo courtesy Lehigh Safety Shoe Company, Emmaus, Pa.

A sole improvement with a four-fold return

Four times longer life! That was the return on a single improvement made in the safety shoes pictured above—as proved in actual wear tests at a big metal-working plant.

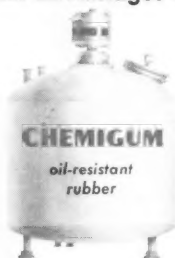
What made the difference was a new kind of sole. It's made of a blend of **CHEMIGUM**, the truly oil-resistant rubber, and **PLIOFLEX**, the light-colored styrene rubber. The end result is outstanding resistance to the cutting oils, metal turnings and sharp grating that so quickly took the toll of the other test shoes.

Other advantages of the new sole include an attrac-

tive, light color, a very comfortable resistance to flexing and abrasion. Equally important are the facts that the **CHEMIGUM** blend is easy to process and can be adjusted to meet any need for oil resistance at minimum cost.

If you're looking for an improvement in any rubber product, why not look into blends of **CHEMIGUM** and **PLIOFLEX**. Full details and technical service are yours by writing to:

Goodyear, Chemical Division, Dept. Q-9418,
Akron 16, Ohio

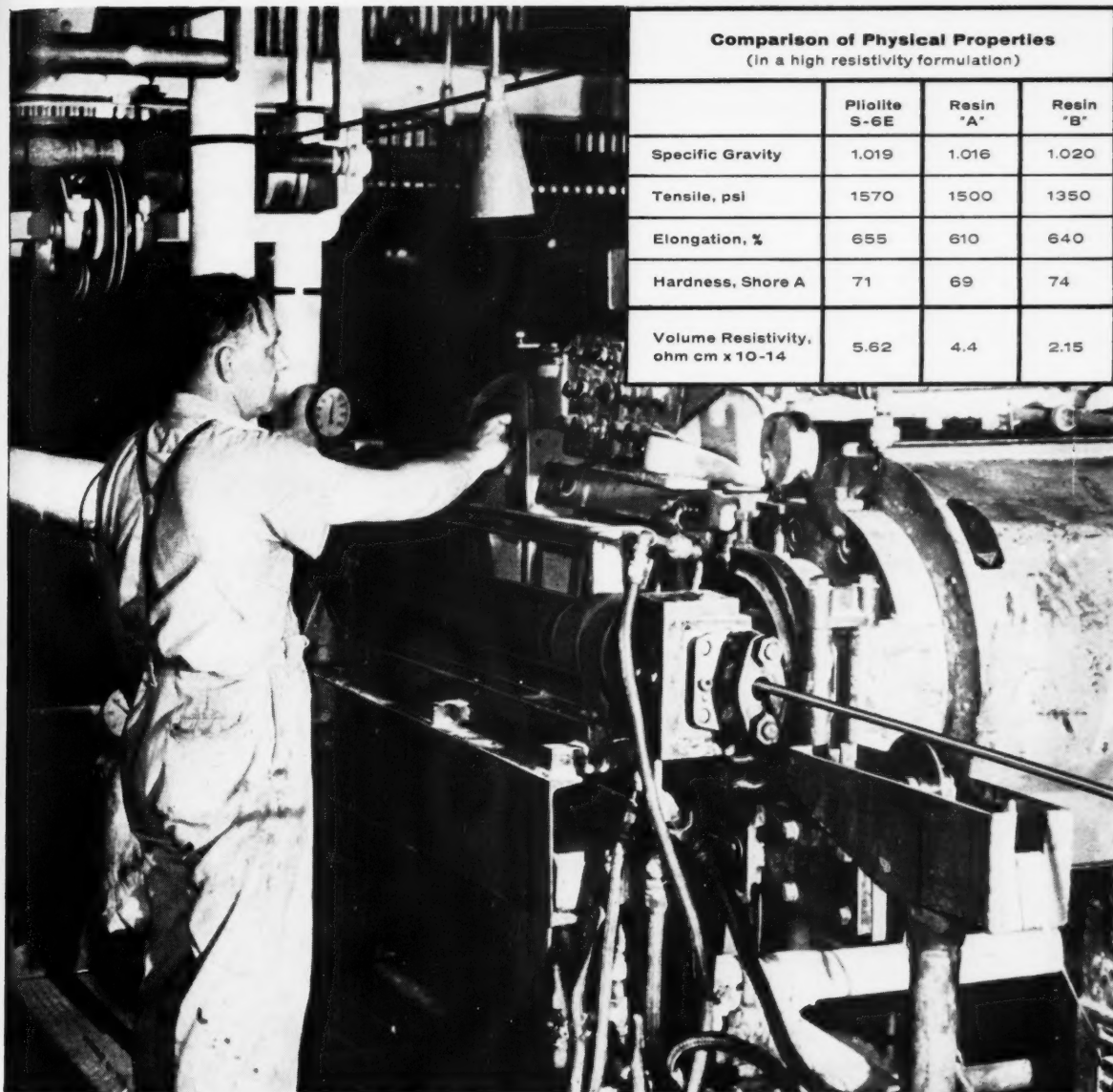


GOOD YEAR

CHEMICAL DIVISION

Chemigum, Plioflex—T. M.'s The Goodyear Tire & Rubber Company, Akron, Ohio





Comparison of Physical Properties
(In a high resistivity formulation)

| | Pliolite S-6E | Resin "A" | Resin "B" |
|---|------------------|--------------|--------------|
| Specific Gravity | 1.019 | 1.016 | 1.020 |
| Tensile, psi | 1570 | 1500 | 1350 |
| Elongation, % | 655 | 610 | 640 |
| Hardness, Shore A | 71 | 69 | 74 |
| Volume Resistivity, ohm cm x 10 ⁻¹⁴ | 5.62 | 4.4 | 2.15 |

Photo courtesy, The Okonite Company, Passaic, New Jersey

New way to meet tight wire "specs"—with ease!

It's here! PLIOLITE S-6E—the new electrical grade, rubber reinforcing resin that will enable you to meet tight wire covering specifications with ease. In trial plant runs, for instance, PLIOLITE S-6E has been particularly successful in meeting the requirements for covering on HW and RW Wire.

PLIOLITE S-6E is a new high styrene/butadiene copolymer which not only exhibits superior electrical properties (see data above), but also proc-

esses and reinforces on a par with any resin on today's market. And best of all, it's offered at the same price as ordinary reinforcing resins.

We think you'll be pleasantly surprised at just how well PLIOLITE S-6E performs. But the best way to find out is to put it through its paces yourself. Samples and full details, including the latest *Tech Book Bulletins*, are yours by writing Goodyear, Chemical Division, Dept. Q-9418, Akron 16, Ohio.



GOOD YEAR

CHEMICAL DIVISION

Pliolite—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

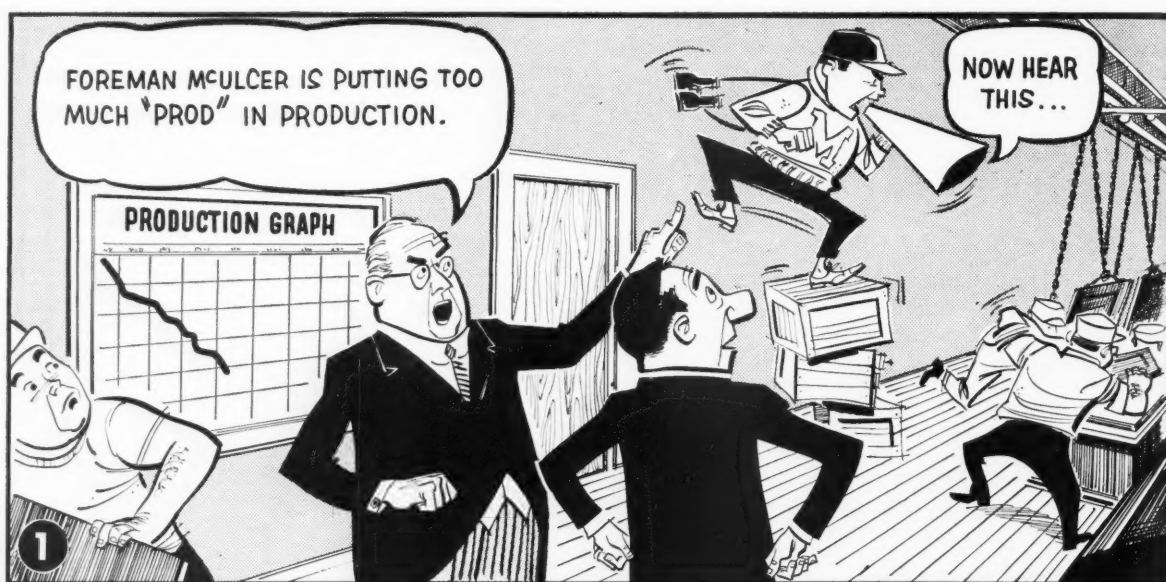
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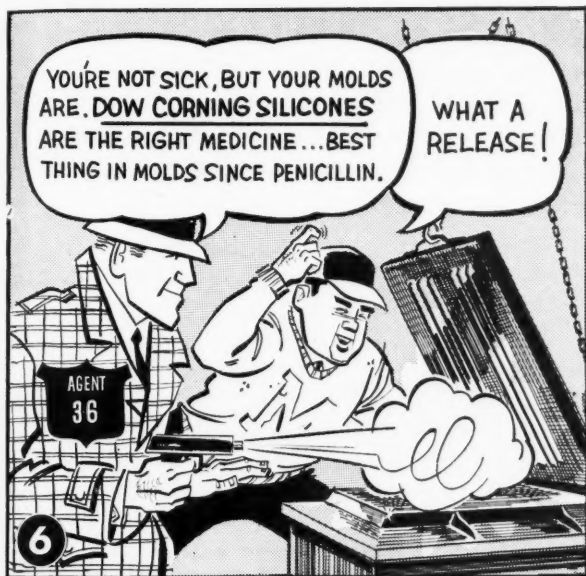


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| Odor | Slight Asphaltic |

MILLEX is a selected Gilsonite base product specially compounded to render it readily miscible with rubber and rubber-like materials.

MILLEX is recommended for use in wire insulation, tapes, soles and heels, boots and shoes, and extruded goods, cured in air or open steam. It is also recommended as a low cost, low gravity extender for semi-rigid vinyl resin compounds.

COMPOUNDING CHARACTERISTICS:

In GR-S, natural or reclaimed rubber, MILLEX improves processing and flattens stocks without undue softening before, during and after cure. Thereby smooth tubing and calendering and clean embossing are obtained. Freedom from flow and sagging in open cures is also enhanced. Good mill release and freedom from tackiness, particularly in high reclaim stocks, are obtained with MILLEX.

Cured stocks show good hardness, modulus and extremely smooth finish. Electrical behavior is excellent and moisture absorption is low.

MILLEX is compatible with vinyl resins and lends itself to semi-rigid uses, such as records, chemical resistant conduits, flooring, paneling, etc.

MILLEX while dark brown in color has relatively low hiding power and can be used for light brown or tan colored compositions, such as soles or heels.

MILLEX should be added directly to GR-S or rubber during breakdown period for best results.

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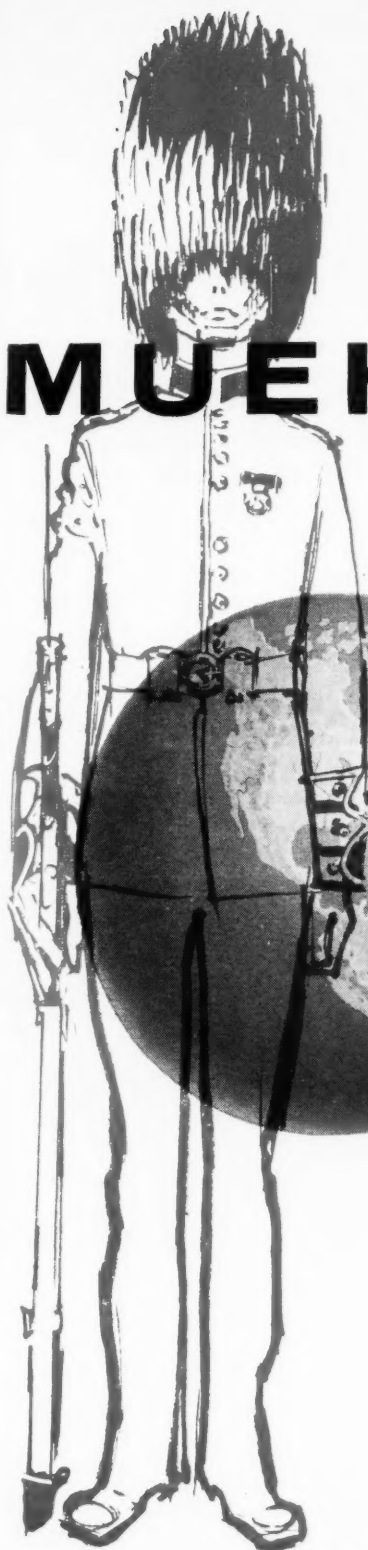
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May, 1958

Congress has voted favorably on a major recommendation of the bipartisan Hoover Commission for a more businesslike budget procedure.

THANKS... AND WELL DONE!

RUBBER WORLD, a member of BILL BROTHERS PUBLICATIONS, expresses its appreciation to all who supported the Hoover Commission recommendation for modernized federal budgeting.

Congratulations to the senators who unanimously passed S.434 and to the representatives who overwhelmingly voted for H.R. 8002.

One victory can lead to another... let's keep the ball rolling for more efficiency and economy in government!

What next?

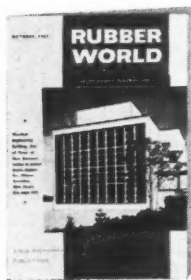
There's other work to be done, as has been noted in these messages. Your continued support is needed.

Target recommendations for this year include (1) a Congressional declaration against needless and costly government competition with private business; (2) modernization of federal personnel proce-

dures and establishment of a senior administrative career service; (3) unified procurement and management of common-use Defense items under civilian control; and (4) coordination of the nation's complicated federal medical programs.

Readers who have already sent for literature (see coupon below) will be informed as additional Hoover Commission recommendations come before Congress for action.

If you have not yet signed up for the background information we invite you to do so at once on the coupon below. There is no cost, no obligation other than your own desire to help in the campaign for more efficient, more economical Federal Government.



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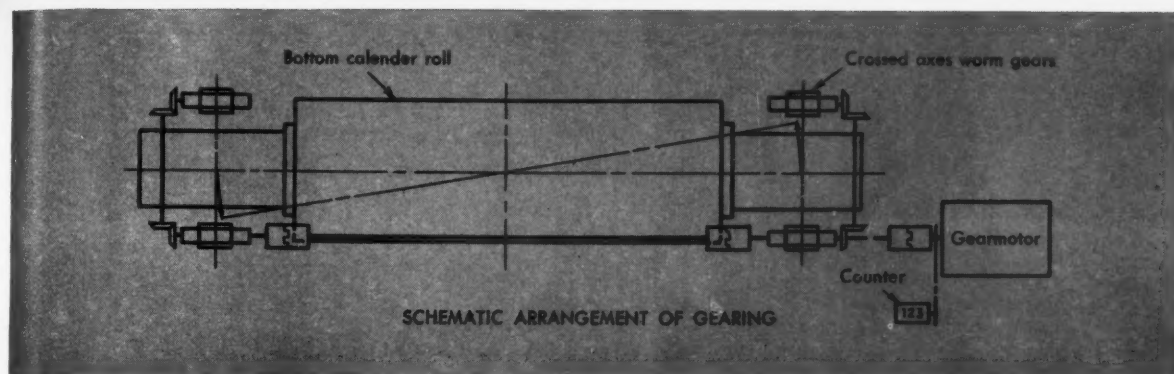


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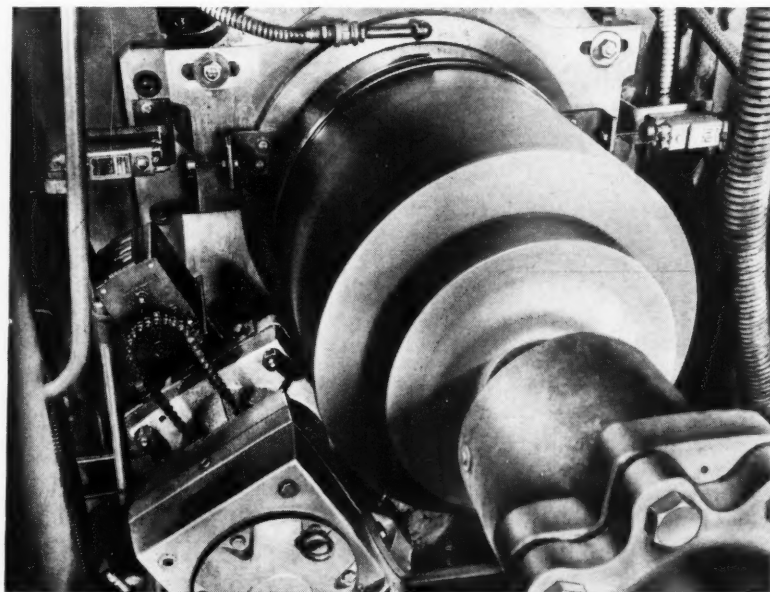
developed by Farrel-Birmingham to apply the crossed-axes principle of roll-crown control to existing calenders which have connecting gears mounted on the rolls. In general, this mechanism can be built into any three-roll or four-roll calender now in service in which the rolls can be removed through the frame openings.

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FOR FURTHER INFORMATION —
As old calenders vary widely in design, quotations covering the crown compensator can be made only after examination of the calender to which the device is to be applied. Wherever the device can be applied, the cost will be a fraction of that of a new machine, and savings in stock and improvements in the product will, in most cases, pay for the installation in a short time.

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The drawing and photo on this page show application of the crown compensator to the bottom roll of a four-roll inverted L calender with 24" diameter rolls. The large-figured counter indicates the amount of roll crossing.

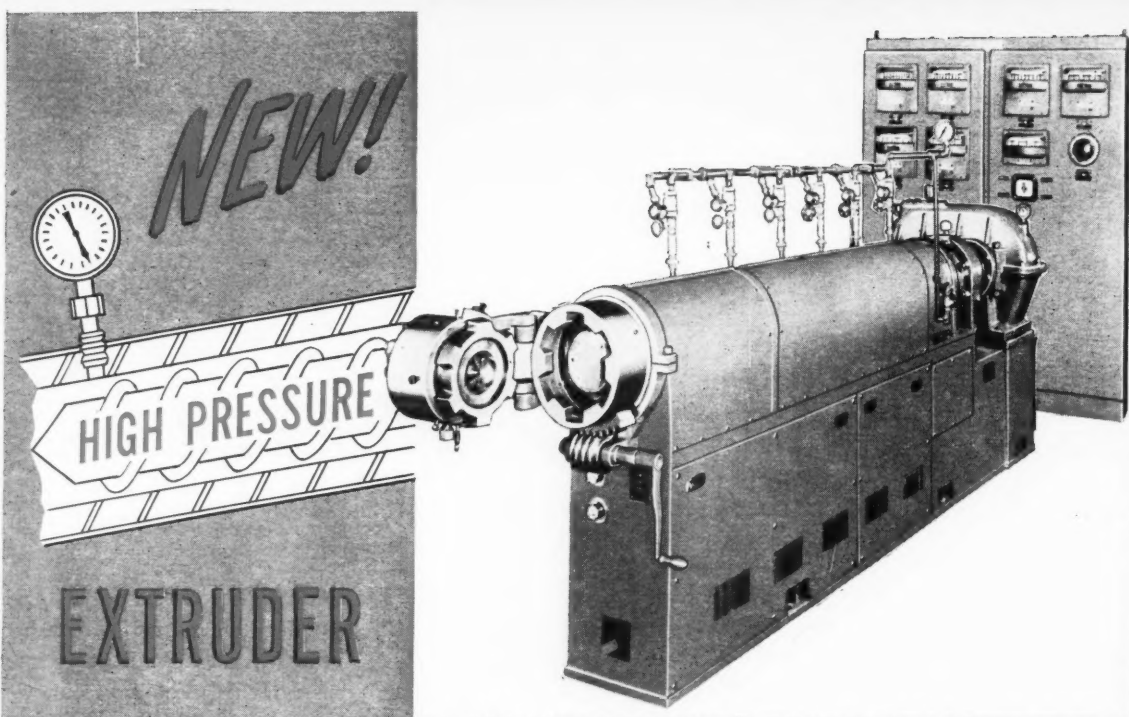
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199



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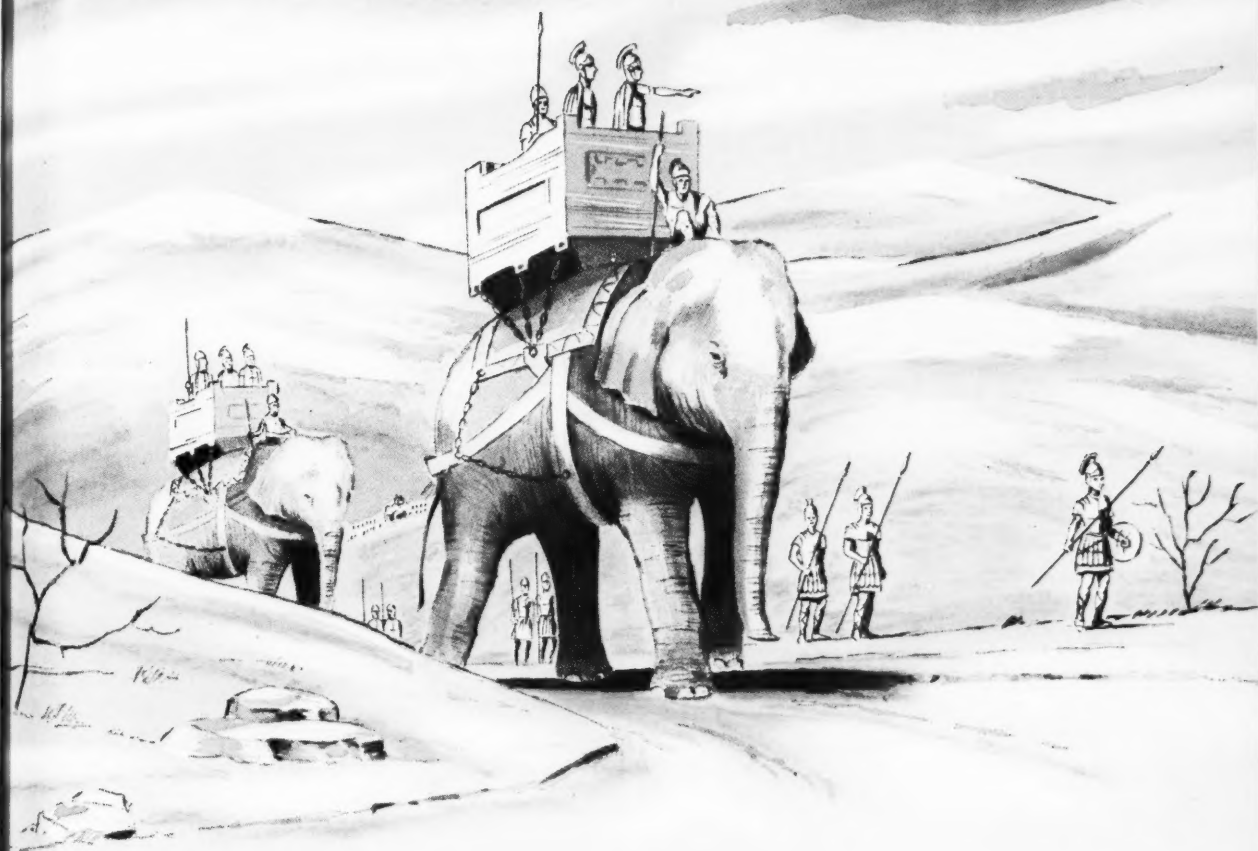
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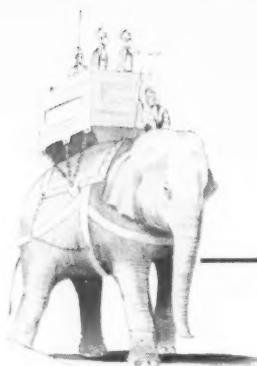
In his search for an adequate means of transportation man has utilized the great strength of the elephant, a most intelligent beast. Hannibal used elephants as part of his "logistics plan" in crossing the Alps and waging war on Rome. But the elephant's skin is easily chafed by harness; in dry weather and in wet weather, too, his feet are liable to become sore, rendering him ineffective as a means of transportation for extended periods of time.

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a letter to rubber formulators
from Neville Chemical Company's
Technical Service Department

Gentlemen:

As a leading manufacturer of hydrocarbon resins, plasticizers and solvents, Neville has collected a large number of useful and tested formulae which have many applications in the rubber and allied industries. If your formulations involve any number of those shown below, we will be happy to send you our suggestions. You may make your request by checking and mailing the coupon shown below, or you may use your own letterhead. There will be no obligation.

1. Tire carcass stock
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4. Bead wire coatings
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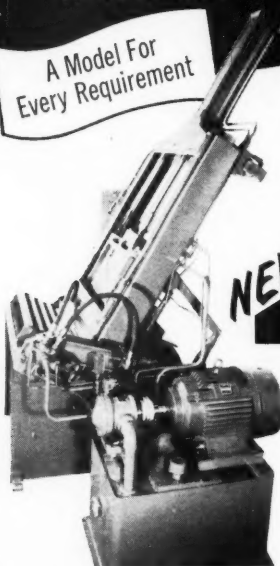
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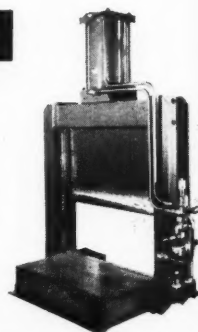
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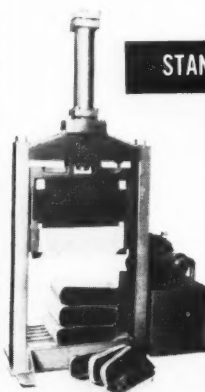
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5. Control blooming in compounds with high loadings.
6. Allow high loadings while maintaining good physical properties and low cost.

More data about INDONEX Plasticizers is available. Inquiries will receive immediate attention.

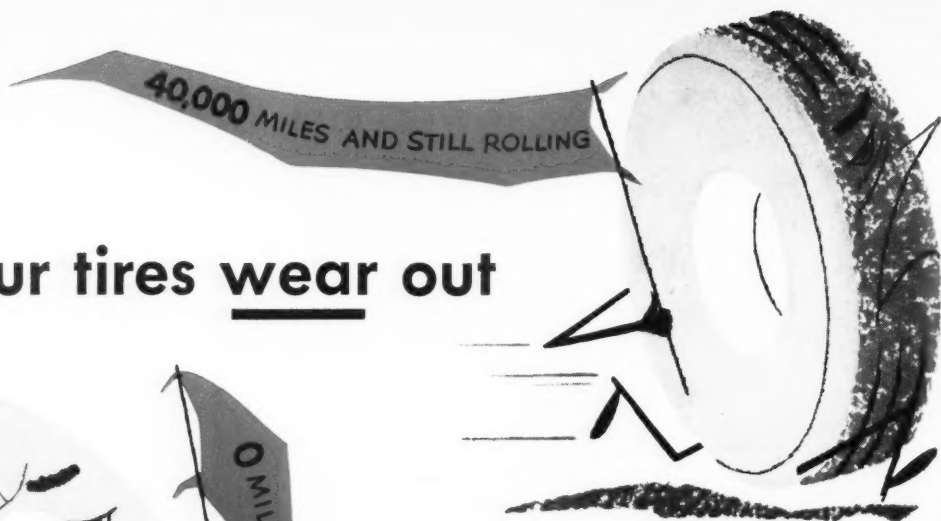


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Grind the mold trim on a tight mill and add very slowly 8 to 10% Polymel RC 57 to the shredded trim, mill together until mass is homogenous. When mixing new batch of same material, add 10% of the reclaimed trim. There will be no change in the hardness or time of cure of the new batch.

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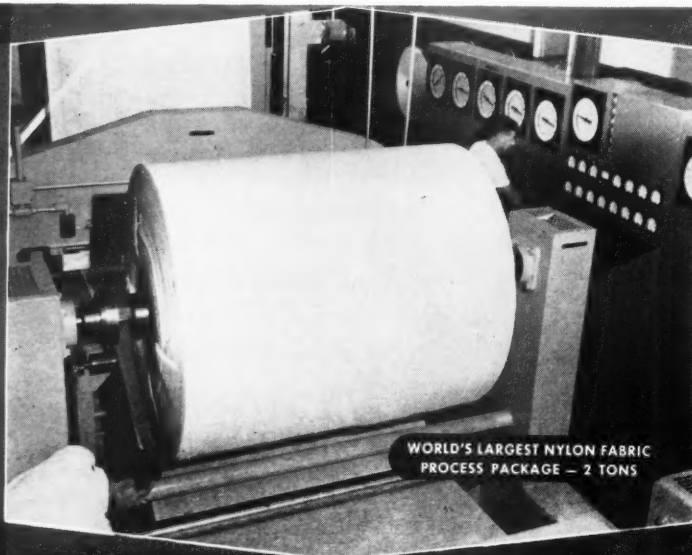
Regardless of the size or volume of work, type of metal or soil, Oakite offers several methods of conditioning metal surfaces for rubber bonding—by barrel, tank or hand. Also a wide number of Oakite materials for use on steel, iron and aluminum.

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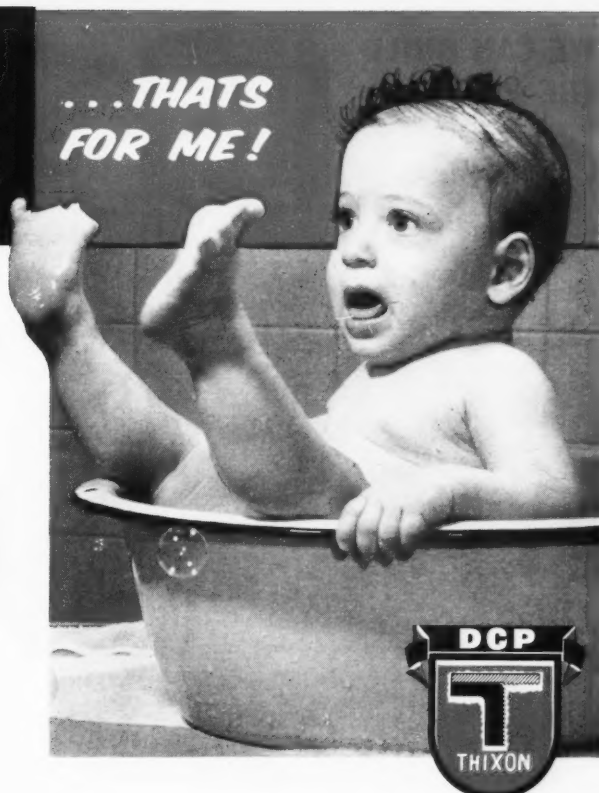
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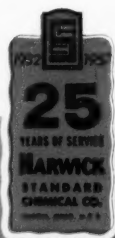


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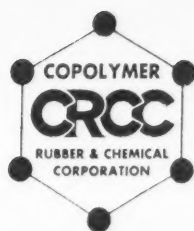
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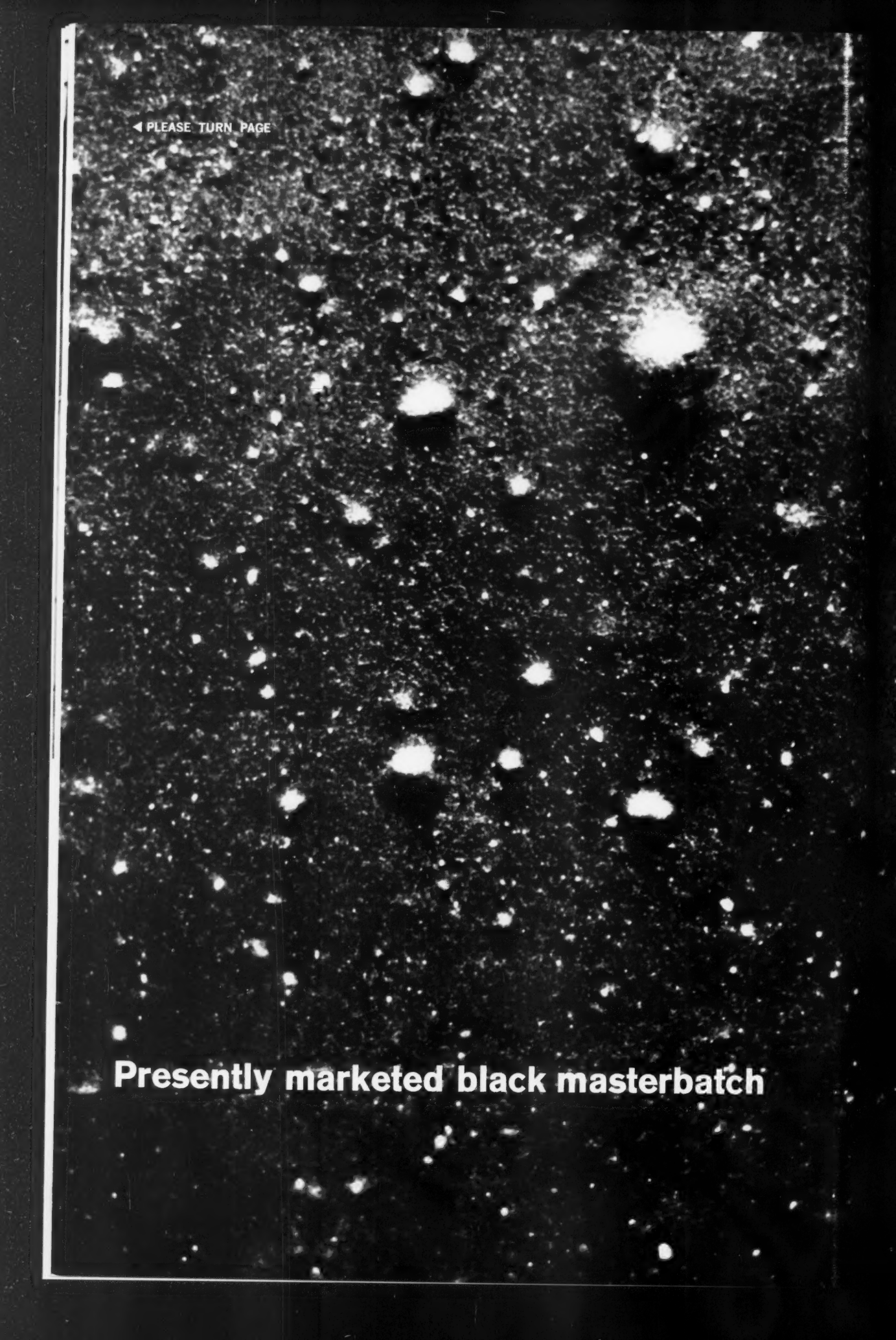


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ON THE PRECEDING 2 PAGES

are unretouched photomicrographs (50 X magnification) of two actual **single-pass** factory mixed tread stocks. On the left is a stock mixed from a presently-marketed black masterbatch. On the right is a stock mixed in identical manner from the new Carbomix 3750 black masterbatch.

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- and at no additional cost.

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So that you can evaluate National Adipic Acid in your own application, we will be glad to send a liberal working sample and to quote on your needs.

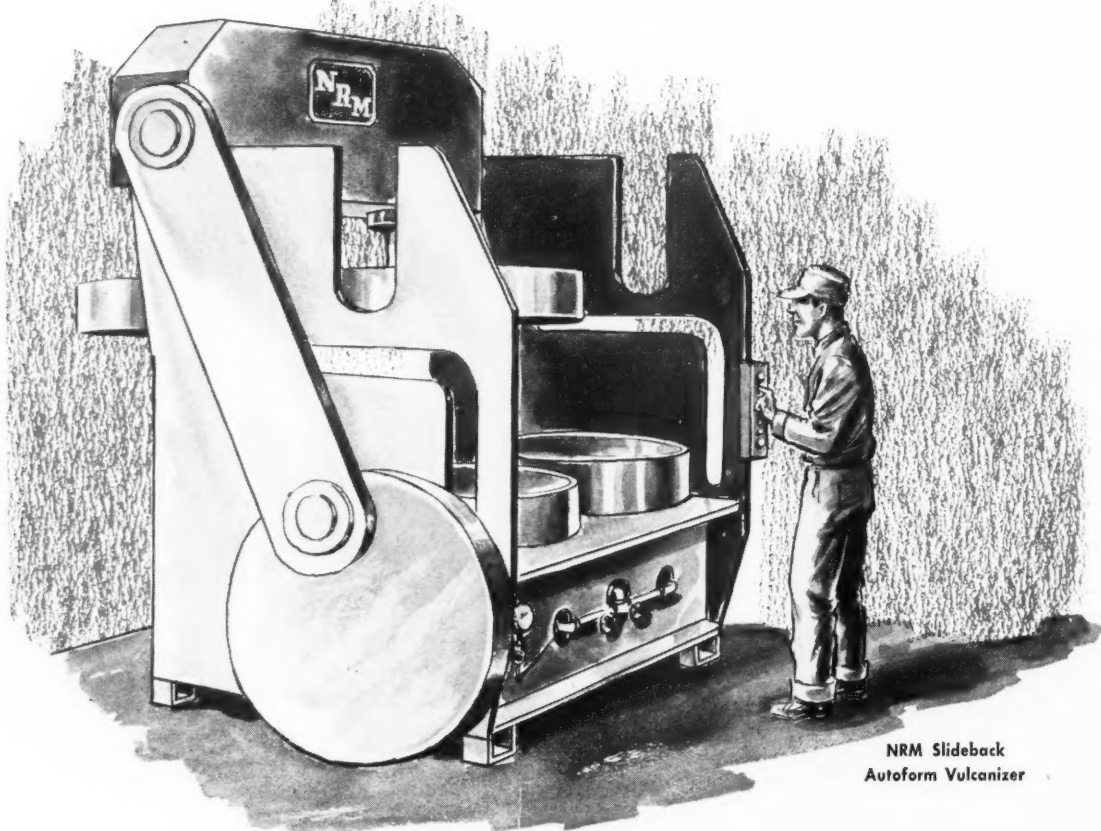
Write also for TECHNICAL BULLETIN J-12R

This 36-page technical bulletin on National Adipic Acid gives physical and chemical properties; principal reactions of the carboxyl and alpha methylene groups; solubility curve, and suggested uses with copious literature references.



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**EXCITING NEWS FOR
THE TIRE INDUSTRY...
NEW
NRM Slideback bladder-type
Autoform VULCANIZER**



**NRM Slideback
Autoform Vulcanizer**

Two important new design features now make NRM Autoform Vulcanizers more productive and profitable than ever . . . The *Slideback* Autoform makes possible less expensive installation of automatic unloading arrangements, permits free access to molds, and provides for installation of automatic post inflators. Furnished either as a conventional bladder type press, or with the NRM bagless curing feature, it includes automatic blow-off, and costs no more initially than presses that do not provide for automatic unloading. One operator can handle up to sixty-

five Slideback Autoform presses (130 cavities) in a normal cure cycle.

The NRM *Bagless* Autoform is the first successful application of the bagless curing principle. Developed in cooperation with one of the world's largest tire companies, it establishes new concepts in *faster* curing, at *lower cost* per cure. Here are some of the performance facts to remember about the Bagless Autoform, in planning expansions and efficiency improvements in your tire plant . . .

New NRM SLIDEBACK Bagless AUTOFORM SAVES UP TO 11½¢ PER TIRE ON CURING COSTS

That's the typical performance of the new NRM Bagless Autoform Vulcanizer. Making it possible is NRM's development of a new-type bead clamping device which permits using the tubeless liner of the tire being cured to hold the curing medium. Internal heating and cooling is thus applied directly to the tire carcass. Elimination of the bladder — along with associated costs in labor, materials and tire spoilage due to bladder failure — results in *faster* curing at savings that can range as high as 11½¢ per tire, or more. Here are a few of the many other ways the Bagless Autoform reduces curing costs and simplifies operations:

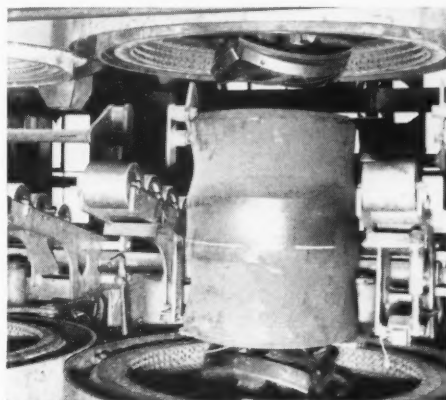
1. Simple construction — Uncomplicated design of the new-type bead clamp assures positive action and minimum maintenance.

2. Complete Flexibility — The bead clamp permits curing all passenger tire sizes of the same bead diameter with the same clamp ring, by allowing for adjustment of bead ledge widths to accommodate changes in tire construction. Specially compounded *resilient* faces on the bead clamps compensate for all normal dimensional variations in the beads, providing for consistently perfect bead molding.

3. No Mold Alterations Required — Present tire molds may be used in bagless curing without changes.

4. More Efficient Loading and Unloading — The Bagless Autoform, combined with Slideback design, permits installation of less complicated, smoother-working automatic loading arrangements.

HOW CURING COSTS ARE REDUCED . . . PROFITS INCREASED . . . with their capacity for 90 or more cures per day per mold, the Bagless Autoform offers the tire industry more productivity per foot of floor space than any other vulcanizer available. In addition to this greater production capacity — and therefore greater *profit-making* capacity — are the many separate savings in material and labor that result from the elimination of bladders. Together, these represent savings up to 11½¢ or more per tire on curing costs.

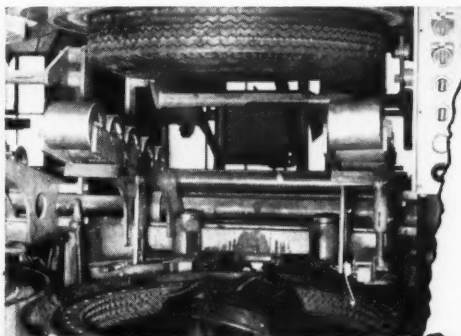


The green tire is automatically placed in the vulcanizer. The bead clamps here seen in retracted position expand as the press closes, gripping the beads and positioning the tire for curing.



This cut-away tire shows position of the bead clamps during curing. Resilient facings on the clamps compensate for dimensional variations of the beads, assuring consistently perfect bead molding.

After curing, the bottom clamp retracts and the tire is lifted by the upper clamp rings, then dropped to the conveyor for automatic unloading.



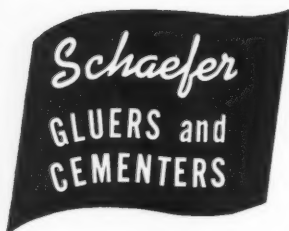
Our engineers will be happy to discuss Slideback and Bagless Autoform Vulcanizers with you in complete detail, and assist in helping you plan for automatic, bagless tire curing in your plant. If you are now using bladder type Autoform Vulcanizers, they can be easily converted to bagless operation.

NATIONAL RUBBER MACHINERY COMPANY

NRM

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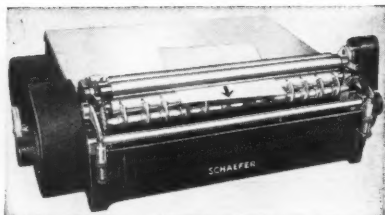
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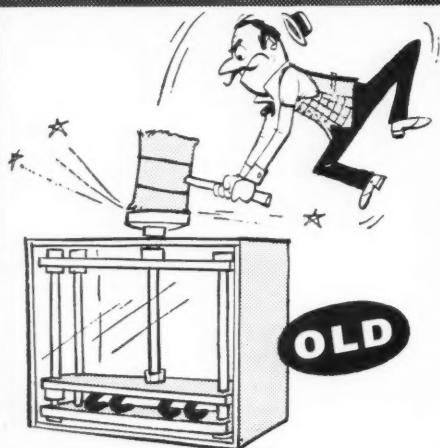
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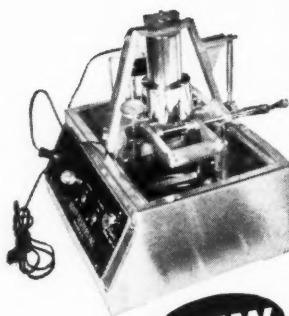
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BRITTLENESS

SCOTT TESTER* MODEL E

With a range of $\pm 50^{\circ}$ to -120°C . Model E Brittle Point Tester is the accepted Industry Standard. It is portable and self contained, with all controls to readily maintain desired temperature. Conforms to

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Narrow boiling range
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— improves quality
of end product!**

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ts "wicking" in chafer fabrics

In co-operation with General Tire's technical staff, tire fabric manufacturers have found the best solution to one of the tire-maker's most troublesome problems—air "wicking" through chafer fabric! Gen-Tac[®] is the answer . . . used on multifilament cord, its outstanding qualities assure positive protection against "wicking" and provide superior rubber-to-fabric adhesion.

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See FEMCO'S "Roll Lift" *AUTOMATIC TRIMMER!

Get your Molded Rubber Goods Trimming operation deep "in the black" with FEMCO's newest machine — the "Roll-Lift" Automatic Trimmer! Speed never before possible — this equipment makes a complete cutting cycle in 26 seconds. The "Roll-Lift" feature doubles the life of the dies and prevents "off-register" cutting because the heavy roller passes only once across the dies on each cutting cycle.

Load the machine with sheets of molded rubber goods direct from the curing line, press a button and the Die Cutting operation is automatic except for removing "flash" from the die. Finished parts drop to take-away conveyor. A woman employee can easily operate this machine.

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Designed
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SEVEN LEAGUE BOOTS

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in your mixing operations

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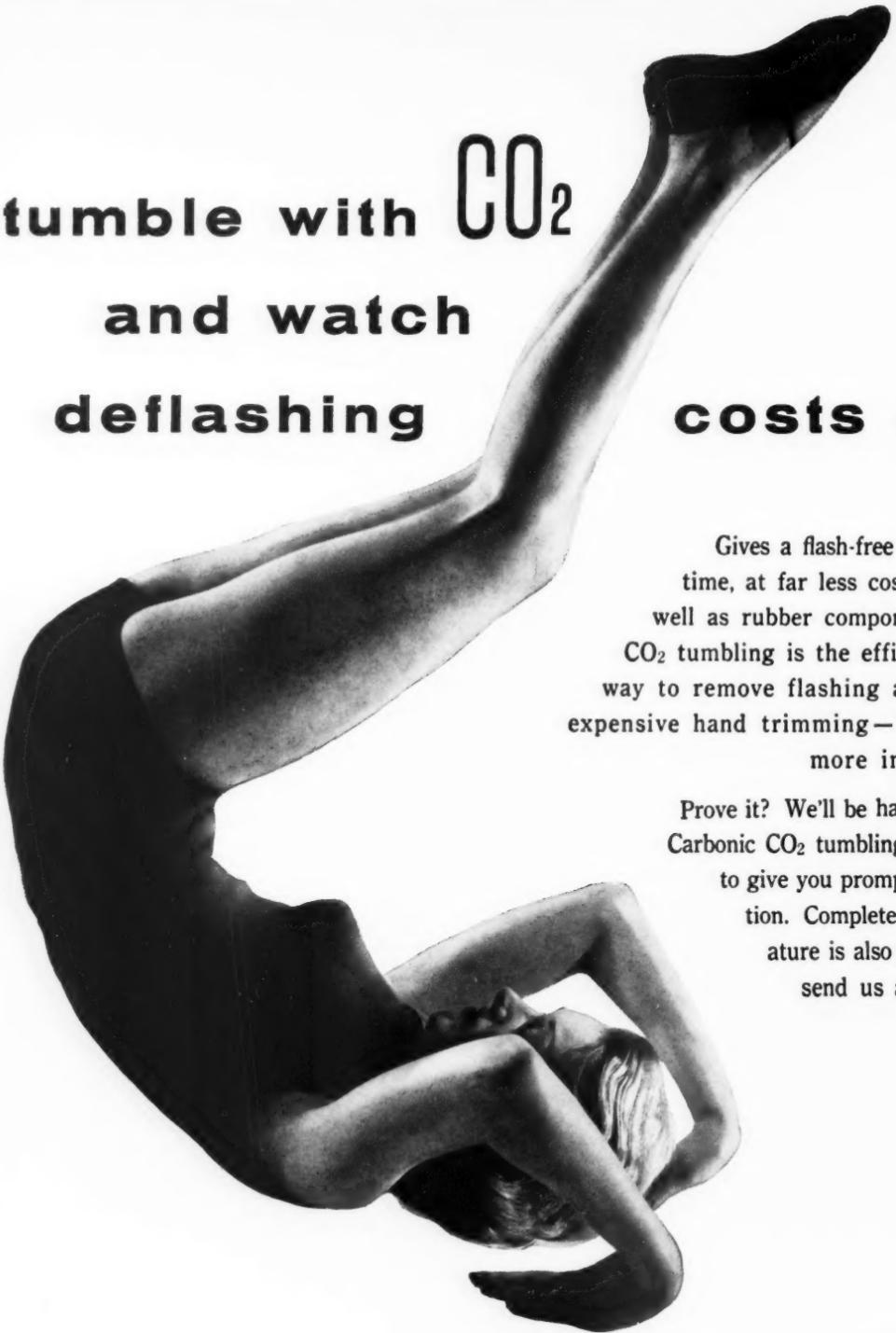


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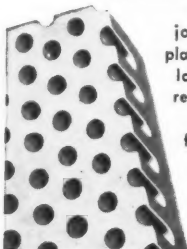
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tumble with **CO₂**
and watch
deflashing **costs drop**

Gives a flash-free finish in far less time, at far less cost. On plastic as well as rubber components and parts. CO₂ tumbling is the efficient, *automatic* way to remove flashing and rind. Ends expensive hand trimming—frees labor for more important work.

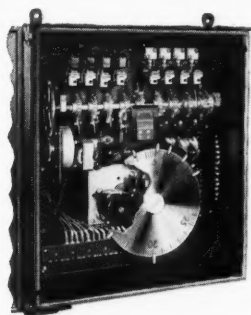
Prove it? We'll be happy to. A Liquid Carbonic CO₂ tumbling expert is ready to give you prompt, personal attention. Complete descriptive literature is also available. Simply send us a letter or card.



CO₂ and Liquid Carbonic know-how are doing a remarkable job in foam rubber and plastics, too. As the world's largest producer, we are ready to supply CO₂ at any pressure desired for the foaming of thermoplastics.

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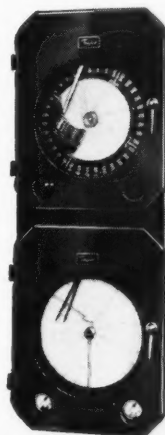
These TAYLOR CONTROLS



The new Taylor FLEX-O-TIMER* Timed Program Controller gives greater precision than ever to the timing and coordination of automatic presses used for vulcanizing tires or any mechanical goods. Actuates switches, turns valves, and performs many other operations involving temperature, pressure, mechanical motion, electrical energy or any combinations of these.

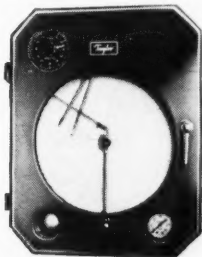
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Taylor's FULSCOPE* Time-Schedule controller will repeat exactly any predetermined program involving temperature, pressure, flow or level, or any two of these. It controls rate of rise, hold periods, and rate of fall, in any desired sequence. Ideally suited for any type of vulcanizer.



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HI-SIL[®] PUTS EXCITING M

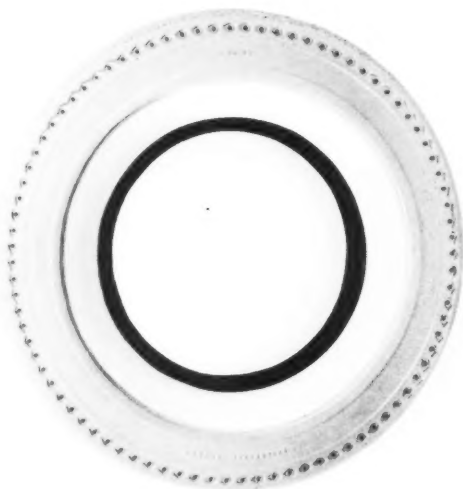


Here is dramatic proof that color stands ready to hurdle another old barrier. This is an actual photograph of the world's first practical colored tires.

Laboratory-made by our Barberton rubber research staff, the solid-color treads and sidewall veneers were then applied to conventional white sidewall undertreads. Building and curing were accomplished in conventional factory tire equipment.

Run against first-line black tires as controls, similar tread stocks have given an excellent account of themselves in extensive road tests. A brief write-up, which will answer some of the many questions about Hi-Sil 233 in this startling new application, is available

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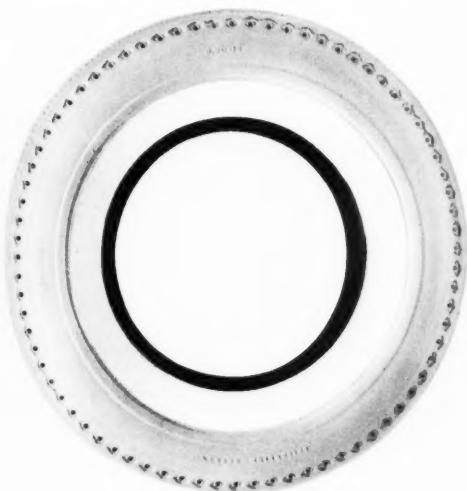
Because Hi-Sil has very low covering power in rubber, the true deep tones... the vivid brights... the subtle pastels you see here are only a few of the unlimited color choices available to match or contrast with *any* background.

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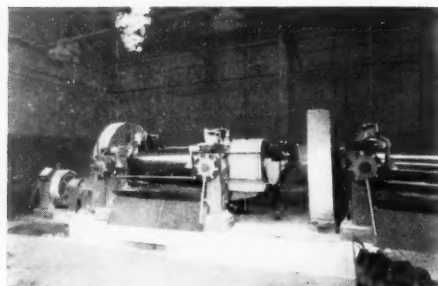
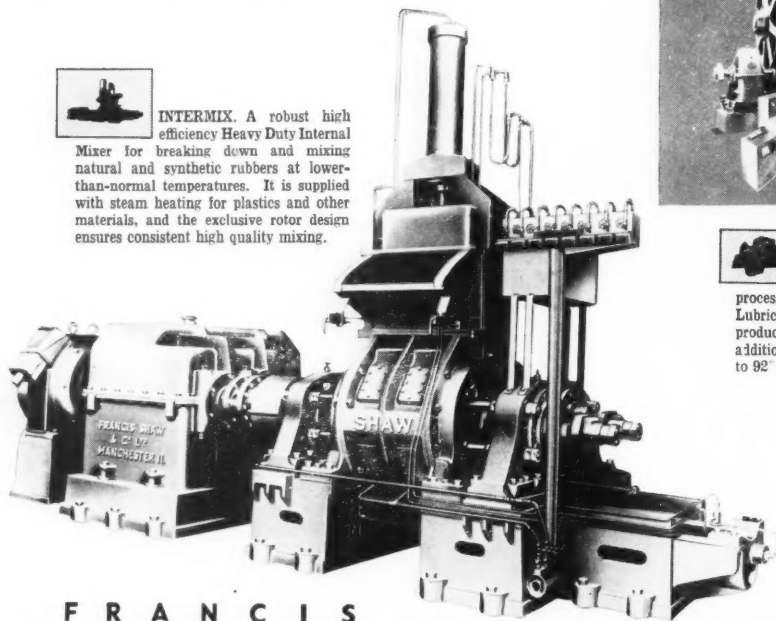
The cost-cutting performance of every Francis Shaw machine and its thorough dependability are the result of long experience and unvaryingly high standards of engineering in every detail of manufacture.

Close-limit accuracy and rigorous inspection during manufacture guarantee to the user a consistently high quality output from Francis Shaw equipment.

*Francis Shaw are available for
the design, manufacture and
installation of a wide range of
processing equipment*

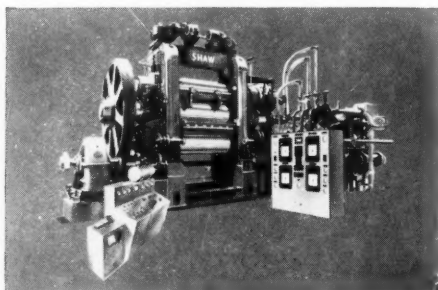


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For the efficient mixing and warming of all thermoplastic-thermosetting materials Shaw produce a range of mills from 13" x 16" up to 84" x 26". Supplied in batteries or with individual drives, these machines are capable of high sustained output. Single or double geared models available. The machine shown is fitted with Lunn Safety Gear.



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NEW...from Du Pont

NEOPRENE TYPE-A D

*A new color- and viscosity-stable neoprene
for quick-setting adhesive cements*

Neoprene Type AD is an improved neoprene for use in adhesive cements, outstanding in its retention of solution viscosity and original color.

VISCOSITY—Neoprene Type AD solutions show high resistance to “drop-off,” or thinning out, during storage. Aged at room temperature, the viscosity of the Type AD polymer shows no significant change. At elevated temperatures, the viscosity increases only slightly.

COLOR—In both chip and solution form, Neoprene Type AD is unusually resistant to discoloration. Water-white toluene solutions keep their clear, light appearance after aging at elevated temperatures. Type AD chips do not darken when stored for long periods. Tests indicate a high

degree of color stability when high “gum” cements are stored in metal drums.

ADHESIVE PROPERTIES—Neoprene Type AD gives the same quick, strong bonds that are typical of the better known adhesive grades of neoprene, and possesses essentially the same curing characteristics. Type AD crystallizes very rapidly at room temperature; it gives outstanding bond strength immediately after the adhesion bond is solvent-free.

Du Pont Neoprene Type AD combines two significant improvements in stability with outstanding adhesive properties. For more information about Neoprene Type AD, contact the district office nearest you or write for Report 58-1.

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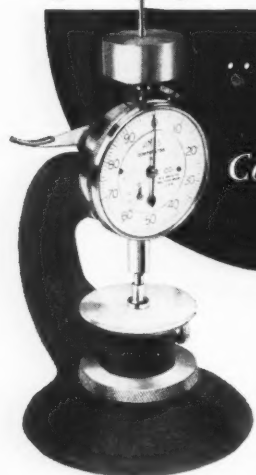
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OREC 0300 series ozone test chambers are entirely automatically controlled with panel instrumentation directly indicating in pphm/volume the ozone concentration at which the test chamber is operating. OREC 0300 series provide ozone concentrations required by all ASTM Specifications, as well as all known Producer, Consumer, and Military Specifications.

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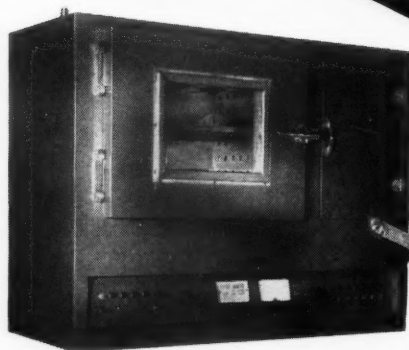
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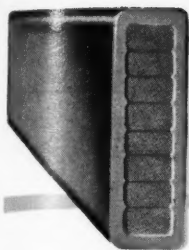


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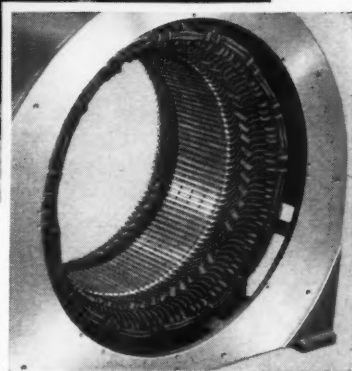
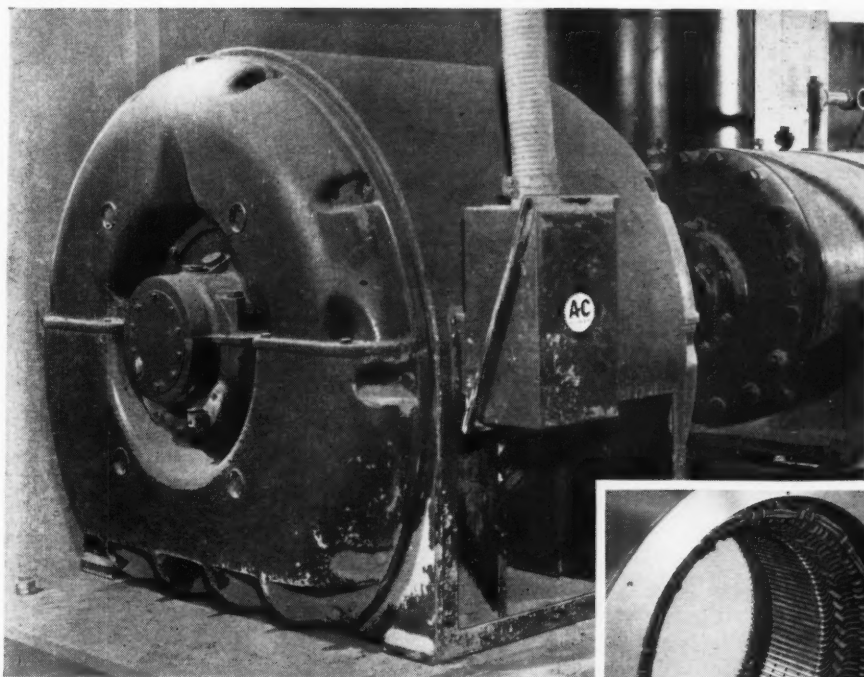
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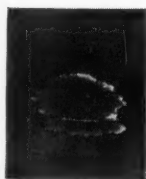


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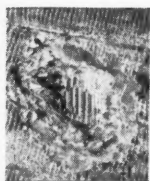
motor with void-free insulation



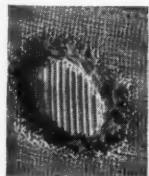
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Silco-Flex
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Polyester
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Asphaltum
Mica Tape

Note difference in abrasion!

Insulation shown after sandblasting for one minute with 90-grit aluminum oxide and 100-psi air from distance of six inches.

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Combined with void-free *Silco-Flex* insulation are integrated mechanical features that make this motor especially suited to your toughest applications.


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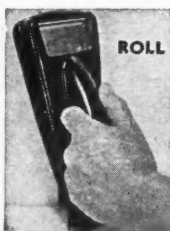
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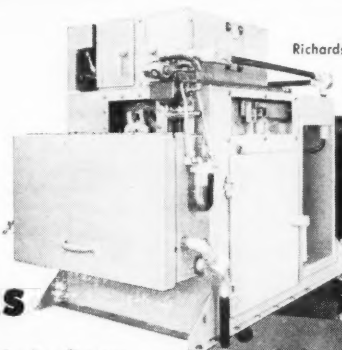
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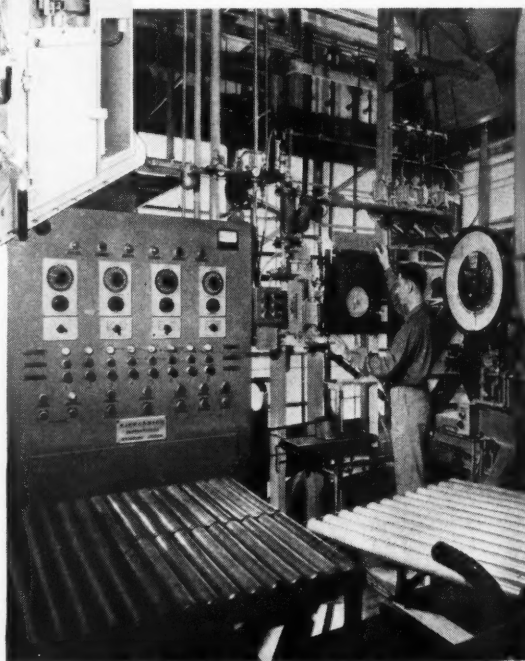
Bulletin 194S
gives details of
these instruments.
They help save
money and make
better rubber.

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Solves
**CARBON BLACK
HANDLING PROBLEMS**



Richardson Model E-50 Bulk Weighing Scale

Richardson Select-O-Weigh Automatic Weight Control



Conforms to U.S. Weights and Measures H-44 for your protection.

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Ameripol 1006 crumb—23% bound styrene copolymer with a non-staining antioxidant.

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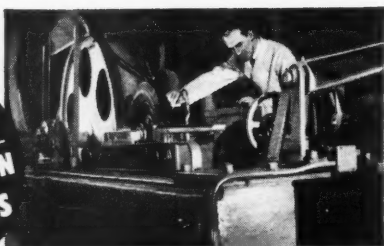
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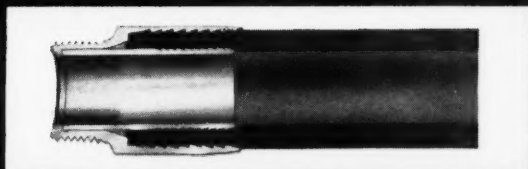
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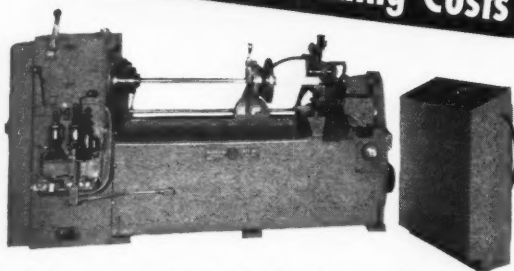
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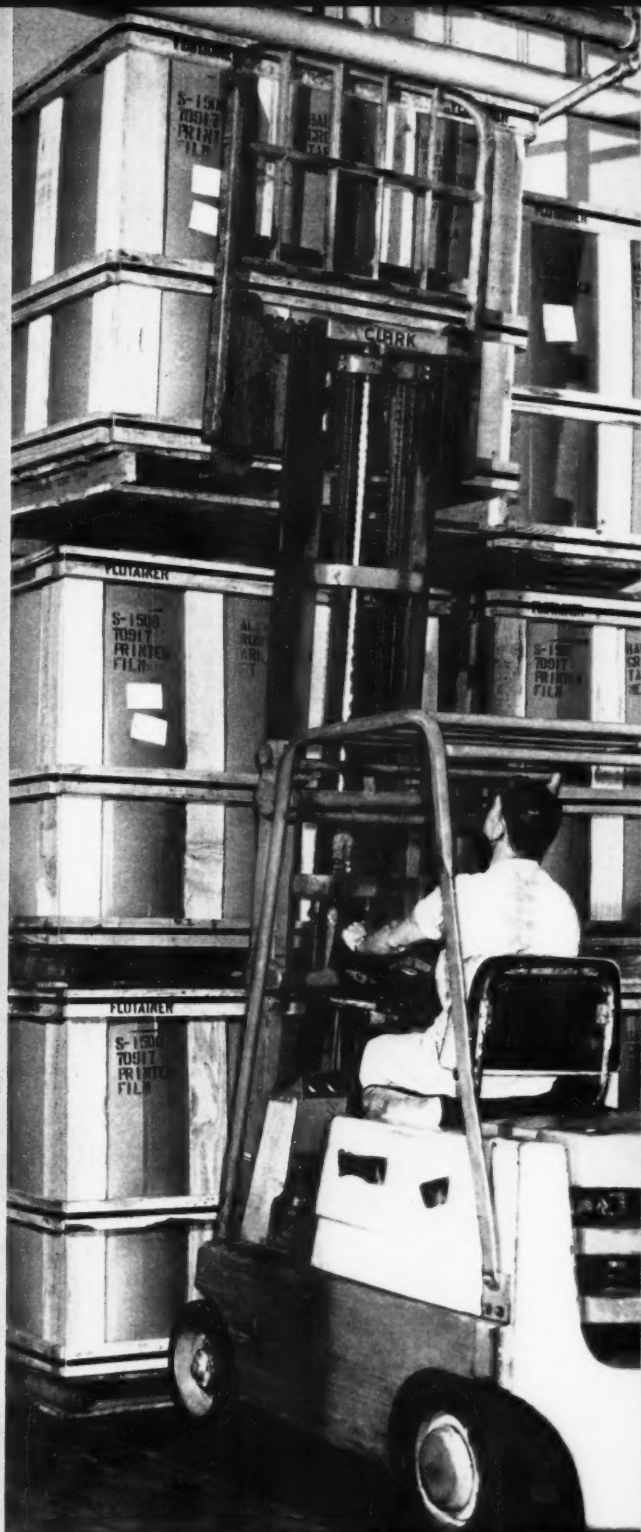
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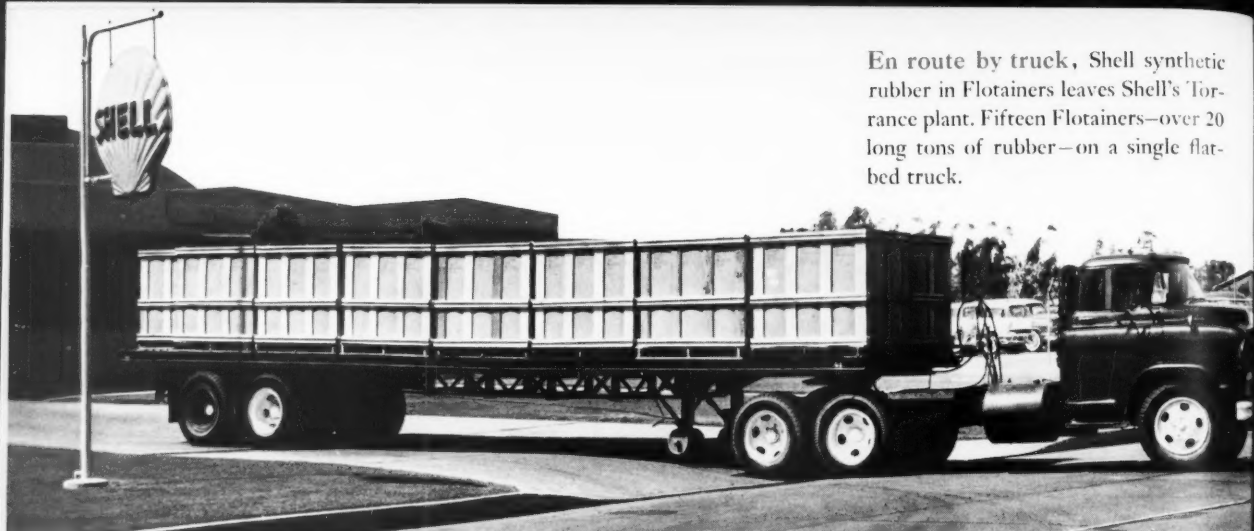


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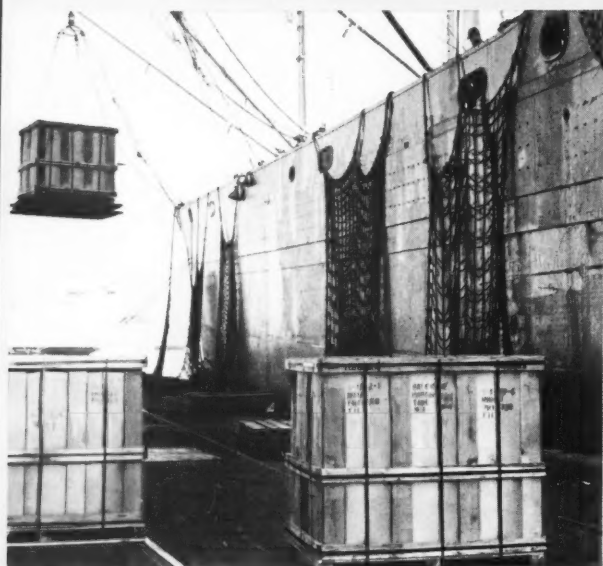


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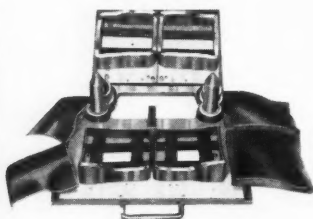


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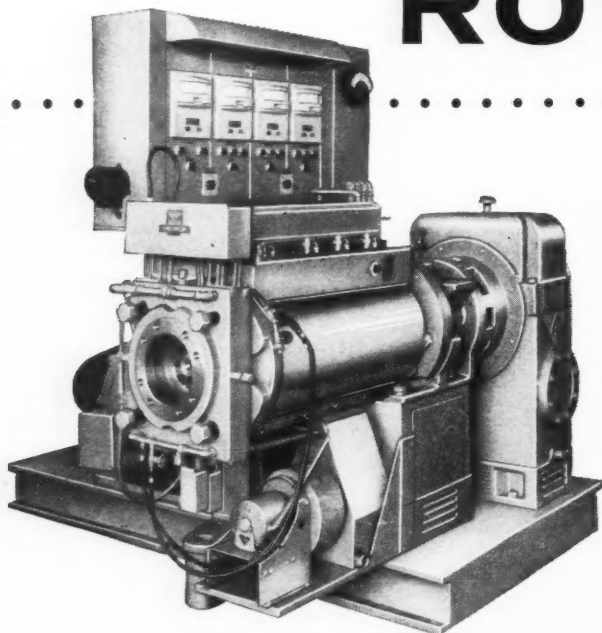
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Industry Needs New Definitions For Rubber and Plastics

THE need of new and workable definitions for "rubber and rubber-like" materials and "plastic" materials in commerce and industry is becoming increasingly urgent. The railroad and trucking industries are classifying, in some instances, products made of rubber as plastics and collecting higher rates on domestic shipments. United States exports of certain synthetic rubbers into some European countries are being classified as plastics, and higher import duties collected because of this lack of generally acceptable and workable definitions.

We called attention to the need of new definitions for "rubbers" and "plastics" in this column in July, 1957, and asked for comments for the purpose of arriving at new and more generally useful definitions, but to date have had only limited response. This effort was made not only because of the interest of the editor of RUBBER WORLD, as such, in this problem, but also because he headed the subcommittee on nomenclature of Committee D-11 on Rubber and Rubber-Like Materials of the American Society for Testing Materials and was the recipient of inquiries from industry for more useful definitions than those in existence.

The most recently proposed definition for a "rubber or rubber-like" material defines it as "one which in the normally compounded state and vulcanized or polymerized produces a product with elastic characteristics which will recover its original size and shape within 5% in less than 3 seconds when compressed to $\frac{3}{4}$ of its original thickness and released, or elongated to double its length for 5 seconds and released." This definition has been recommended for letter-ballot in ASTM Committee D-11 for adoption as part of a "Tentative Recommended Practice for Nomenclature for Elastomers."

One correspondent objects to this latest proposal

since he believes that "the specification attached to the proposed definition would allow only a few of the present commercial polymers to be classified as rubber-like materials." He goes on to say that it seems apparent that current developments will lead to more plastic-like rubbers and more rubber-like plastics. Either we must provide broad definitions that will divide the field at an intermediate position between highly rubber-like and highly plastic-like materials or be prepared to designate a new intermediate class of materials with the prospect that a large proportion of the future commercial polymers will fall into the intermediate classification.

He adds that the proposed definition suggests test conditions and limits that are more severe and limiting than those recommended and published by ASTM Committee D-11 for commercially acceptable rubber vulcanizates. It would be necessary to include test recipes and other details in the proposed definition if it were to serve any purpose in its present form.

We feel that this correspondent has made several good points, but many more such expressions of opinion are needed and soon, if we are to develop workable definitions useful to industry and government in legal cases and as a basis for specifications and purchasing standards. *Please direct your comments to the editor of RUBBER WORLD in order that they may be available for consideration at the next meeting of the ASTM in June.*

R. G. Seaman
EDITOR

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RUBBER WORLD

Tires for Today's Cars¹

By R. P. DINSMORE

Goodyear Tire & Rubber Co., Akron, O.

FOR just about 60 years pneumatic tires have been used to equip commercial automobiles in this country. In that period a drastic change has taken place in the character of the public highways, the performance of the automobile, and, necessarily, the construction of the tire. These changes have occurred, mostly, as a gradual evolution, but the last five years have produced some very marked and rapid modifications.

In this period the turnpike and the freeway have become potent factors in our public highway system. Because of these, it is possible to travel for long distances at sustained high speeds, whether the weather be hot or cold.

At the same time, the automobile has increased in size and weight. There have been extraordinary increases in its power, its capacity for speed, its accelerating and braking capacity, and in its lateral stability and ease of steering.

To meet the demands of the automobile, tires have been required to undergo a rapid and continuous evolution. A tire which cannot run for an hour under summer conditions at a sustained speed of 100 miles per hour is not an acceptable piece of equipment for a modern automobile. This is true even of winter tires designed chiefly to give dependable operation in mud, ice, and snow. This same tire must withstand the effects of fast starting and stopping and travel around curves at high speeds as well as the bruising and shearing effects of fast speeds over rough roads which formerly would have been too uncomfortable and dangerous to navigate at these rates.

It is interesting to note that most drivers do not realize that they are driving any faster than they did a few years ago. The comfort and ease of operation of the modern car produces this illusion. Many accidents result from failure of the driver to understand that power steering and power brakes do not cause an

TABLE 1. EFFECT OF BRAKING AND ACCELERATION ON TREAD WEAR—50 MPH. MAXIMUM SPEED

| | Tread Wear Rating |
|----------------------------|-------------------|
| Continuous driving | 100 |
| Control stop every 5 miles | 51 |

NOTE: Same size 14-inch tires used throughout.

automobile to stay in control at speeds of 60 to 120 miles per hour, to the degree formerly experienced at speeds under 60.

Driver psychology, however, is not the theme of this talk. I would like to examine with you the effects of some of the modern conditions in tire performance and mention the things which tire designers are doing to offset them.

Factors Affecting Tread Wear

We shall first examine the effect of starting and stopping on rate of tread wear. We ran a car at 50 miles per hour continuously with no brake stops. We then ran the car at the same speed, but every five miles the car was stopped and immediately started again and brought up to speed. This was done without sliding the tires either in starting or stopping.

Table 1 shows that the tires which were subjected to stops wore out twice as fast as those which were not. City driving requires slower speeds, but many more stops. Former tests show that braking every 500 feet accelerates wear seven times as compared to braking every $4\frac{1}{2}$ miles—all at 25 miles per hour.

What of the effect of speed by itself? As we go, by 10-mile increments, from 50 to 80 miles per hour, the rate of wear increases, as shown in Table 2. From 50 miles per hour to 80 miles per hour, the wear rating drops about 22% for each 10-mile increment (based on rating at the previous speed). Or, if we keep 50

¹ Presented before the Washington Rubber Group, Washington, D. C., Feb. 18, 1958.

TABLE 2. EFFECT OF SPEED ON TREAD WEAR—
PASSENGER-CAR TIRES

| Speed Mph. | Tread Wear Rating |
|------------|-------------------|
| 50 | 100 |
| 60 | 79 |
| 70 | 63 |
| 80 | 43 |

miles per hour as a permanent base, changing from 50 to 80 increased rate of wear by 57%.

At this point I looked back at some figures I used in a talk in 1952 when we were more interested in speeds between 35 and 55 miles per hour. Between these speeds, rate of wear changed 50%. If we adopt 35 miles per hour as the permanent base, by the time we reach 80 miles per hour the tread wear is only 26% as good as at 35 miles per hour!

Another check was made on tires run for 10,000 miles at 65 mph.; then the speed was increased to 70, and the tires were run until smooth. Another group of the same lot of tires was run until smooth at 85 mph. The tread of this last group dropped to about half as Table 3 shows.

TABLE 3. EFFECT OF SPEED ON TREAD WEAR—
PASSENGER-CAR TIRES

| Speed Mph. | Mileage to Smooth | Tread Wear Rating |
|------------|-------------------|-------------------|
| 65-70 | 16,630 | 100 |
| 85 | 8,955 | 54 |

The rate of wear at a given speed is not an invariable quantity; neither is the relation or rate of wear between two different speeds. This is because of the effect of temperature, road surface, frequency of curves, and number and slope of hills. For these reasons you will see various figures for relative wear. The ones I have used are intended to be conservative in that they represent a median position.

Speed has other effects. In Table 4 we see that groove cracking develops with ever-increasing rapidity as speeds increase. Cracking developed in 7,000 miles at 60 mph.; but at 100 mph. in 100 miles.

But people are hard to convince. This is particularly true of driving habits, as they vary from year to year. We took three models of a popular car made in 1953, 1955, and 1957, respectively. Some of the important facts are shown in Table 5.

TABLE 4. EFFECT OF SPEED ON GROOVE CRACKING—
PASSENGER-CAR TIRES

| Speed Mph. | Miles To Develop Cracking |
|------------|---------------------------|
| 60 | 7,000 |
| 80 | 1,000 |
| 100 | 100 |

TABLE 5. EFFECT OF CAR-MODEL YEAR ON TREAD WEAR

| Cylinders | Model Year | Approximate | Power | | Tread | |
|-----------|------------|-------------|----------|--------------|-------------|--------------|
| | | Hp Rating | Steering | Power Brakes | Wear Fronts | Rating Rears |
| 6 | 1953 | 100 | 0 | 0 | 100 | 100 |
| 8 | 1955 | 150 | 0 | 0 | 85 | 75 |
| 8 | 1957 | 250 | yes | yes | 80 | 60 |

NOTE: Same size (14-inch) tires used. Maximum speed 50 mph.

These three cars were driven in a convoy, by skilled test drivers, on the 50-mph., five-mile stop and start previously described. Actually, the change from the six-cylinder car to the heavier eight-cylinder vehicle made more difference than the greater increase in horsepower and the addition of power brakes and steering in the 1957 model. This situation, however, might not hold true for less experienced drivers.

What about temperature? We know that even in the latitude of Washington, D. C., temperatures vary from below freezing to 90° or 95° F., depending on the season. Extremes of 35-40° F. below 0 are experienced in the northwestern United States, and summer temperatures in parts of the South will hang around 100° F. for considerable periods of time. Sustained speeds also heat up tires, as does underinflation or overload, even at moderate speeds.

The effect of speed on tire temperature is shown in a chart recently published in a brochure "Passenger Car Tires"² put out by the Rubber Manufacturers Association. The data correspond to those presented by M. R. Hershey, of Firestone,³ before the Society of Automotive Engineers in June, 1957. In Figure 1 we see the effect of both speed and load.

In examining specific effects of increased temperature, we find that a change from 50 to 85° F. accelerates tread wear by about 20% (fast wear) or 33% (slow wear). (Figure 2.)

Other features, however, must be considered besides tread wear. The cord which gives the tire most of its bruise resistance is weakened by heat (unless it is made of an inorganic material like steel). (Table 6.)

² "Passenger Car Tires—Care and Service." The Rubber Manufacturers Association, Inc., New York, N. Y. (1957).

³ SAE Journal, July, 1957, p. 85.

TABLE 6. HIGH-TEMPERATURE DEGRADATION OF TIRE
CORD MATERIALS

| Cord Material | Strength Retained after 100-Hr. Exposure (% of Original) | |
|---------------|---|---------|
| | 250° F. | 350° F. |
| Cotton | 53 | 0 |
| Rayon | 31 | 0 |
| Nylon | 69 | 21 |
| Wire | 97 | 95 |

Tires for Today's Cars

To meet the demands of the modern automobile with its increased power, speed, and maneuverability, tires have been required to undergo a rapid and continuous evolution, particularly during the past five years. A tire which cannot run for an hour under summer conditions at a sustained speed of 100 miles per hour is not an acceptable piece of equipment for today's automobile. This same tire must withstand the effects of fast starting and stopping and travel around curves at high speeds as well as the bruising and shearing effects of fast speeds over rough roads.

Some of the effects of these and other factors on the performance of present-day tires and the things that tire designers are doing to meet these new demands are explained in this paper.

For example, the effect of frequent braking and acceleration may reduce the tread wear rating of a tire to one-half the rating for continuous driving, a speed of 80 mph. may reduce this rating to 43% of the value at 50 mph.; and it requires only 100 miles at 100 mph. to develop groove cracking, as compared with 7,000 miles at 60 mph. since groove cracking develops very rapidly at such high speeds.

The cord materials and rubber compounds used in today's tires are weakened by the elevated temperatures produced during high-speed turnpike driving. Although nylon tire cord has shown many superiorities over rayon cord, the obstacle to the complete replacement of rayon by nylon is its cost. The most temperature-resistant tire cord material is steel wire, but there does not seem to be much prospect for making a passenger-car tire of wire cord that would give the freedom from noise and road shock and vibration which is required by the driver of the modern American automobile.

Irregularities in today's tires, some of which are capable of being found by methods available to the tire engineer and some of which are not, may form beats in the fundamental frequencies which produce objectionable results that may be audible or may be noticed chiefly in shake and vertical vibration of the car. These effects vary not only with tires, but with cars. Continued study of the causes of these effects and close cooperation between car manufacturers and tire engineers will be necessary to keep pace with the continually rising standards of the motoring public.

Rubber compounds, especially those made from styrene-butadiene (SBR) synthetic rubber, are weakened by elevated temperatures: they drop in strength and tear resistance, but fortunately increase in resilience. If this latter point were not so, internal heat would increase rapidly and destroy the tire. Actually, under severe conditions, it does so.

Figures 3 and 4 show the effect of heat on tensile and resilience of tread stocks of natural, cold or 41° F. SBR,

oil-extended SBR, and butyl rubber.

Figure 5 shows the effect of temperatures on cord adhesion in a natural rubber compound.

One should note also that the effect (instantaneous) of elevated temperatures on these rubber characteristics influences tread wear, the bond strength of rubber to the cord plies, the adhesion of the tread to the carcass, the shear resistance between plies, and other vital tire features.

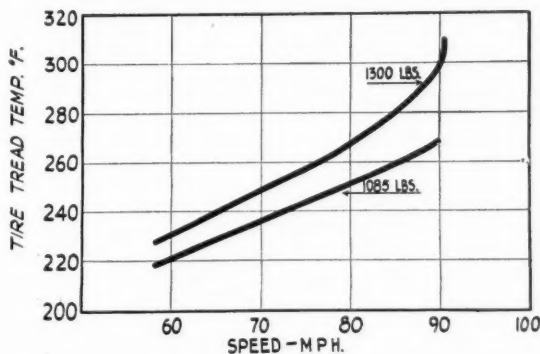


Fig. 1. Tire temperature vs. speed for 7.50 by 14 tire. Inflation pressure, 24 psi.; air temperature, 100° F.; two different loadings

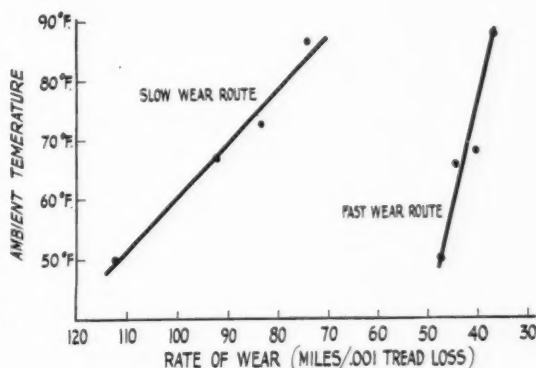


Fig. 2. Effect of temperature on rate of wear of passenger-car treads made from oil extended SBR

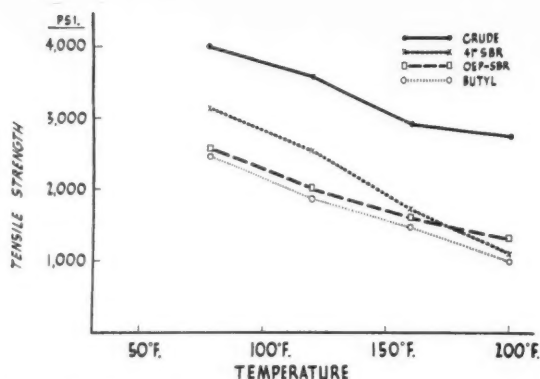


Fig. 3. Effect of temperature on tensile strength of passenger-car tire-tread compounds made from different rubbers

When a tire is deflected by load, it flattens out at the ground contact until the area touching the ground is large enough so that when multiplied by the tire inflation pressure, it equals the load on the axle with which the tire is associated. If the tire is deflected more than 25%, it creates an undue amount of internal friction, the temperature rises rapidly, and the cords and compounds weaken, as we have seen. If the inflation pressure is increased, the deflection is reduced and can be returned to normal. If, however, the load is higher than that which the tire was designed to take, the higher inflation pressure overstresses the cords, thus subjecting them to flexing fatigue, lessening their bruise resistance, and placing undue stress at bead tie-ins and between the cords. Also, the tire absorbs more air into its structure, a process that tends to start separation blisters. All of these troubles are accentuated by higher speeds.

Cord Materials

The tire engineer, however, must take conditions as he finds them and provide for them as best he can. He has a choice of bigger tires, stronger, but thinner tires, better cords and rubbers. In all of these he finds

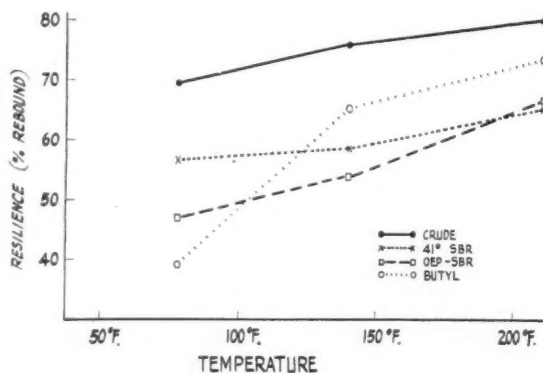


Fig. 4. Effect of temperature on resilience of passenger-car tire-tread compound made from different rubbers

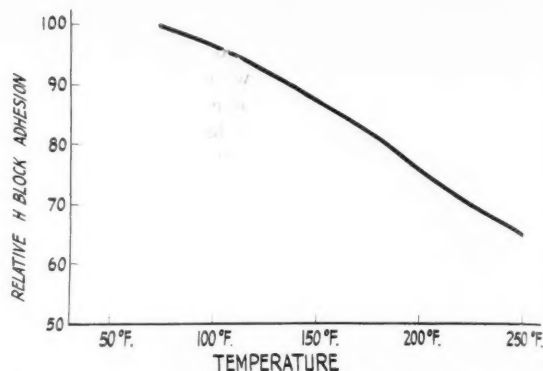


Fig. 5. Effect of temperature on cord adhesion in a natural rubber carcass compound

some limitations imposed by costs, vehicle clearances, and the inherent characteristics of the materials he uses. This is hardly the occasion to discuss costs and vehicle clearances, but some comparison of materials' characteristics may be of interest.

Let us look first at cord materials.

In general we must have cords that will retain enough strength and fatigue resistance, when hot, to perform well. Also, they must bond well to the rubber compounds, fighting heat and rapid flexing. These are some comparisons.

We have already observed how cotton and rayon lose all their tensile strength at very high temperatures (350° F.). In Table 7 we see the comparison of resistance to bruise and fatigue of the four cord materials previously shown. Wire is shown here to indicate its very high static bruise resistance. Its elongation is so low that the other tests for dynamic bruise and fatigue are not significant when applied to it. As a matter of fact, the very high strength of steel enables it to resist sharp deformations which, when experienced, produce early fatigue. For passenger tires, steel cords produce tires which are too rigid to absorb small impacts by envelopment, so the tires made of this material are too rough for present-day American cars. Trucks and other large vehicles are quite a different matter.

TABLE 7. CORD PERFORMANCE IN PASSENGER-CAR TIRES (EQUIVALENT TEST CONDITION)

| Cord Material | Bruise Resistance | | Fabric Fatigue, Miles to Failure |
|-----------------------------------|-------------------|---------------------------|----------------------------------|
| | Static, In./Lbs. | Dynamic, Miles to Failure | |
| Cotton, 4-Ply, 11/4/2, no breaker | 1,000 | 15 | 12,000 |
| Super Rayon, 4-ply, 1650/2 | 5,000 | 200 | 15,000 |
| Super Super Rayon, 4-ply, 1650/2 | 6,000 | 400 | 15,000 |
| Nylon, 4-ply, 840/2 | 10,500 | 1,000 (no failure) | 20,000 |
| Wire, X—construction | 14,500 | — | — |

It should be observed that rayon, being a higher strength cord, can be made smaller than the cotton cord it replaced. The same can be said of nylon with respect to rayon. This situation has two advantages. A thinner tire of adequate strength can be made which, therefore, heats up less, and it requires less rubber compound and thus saves some of that cost.

Table 8 shows the relation between hysteresis for cotton, rayon, and nylon at normal and high temperatures. Cotton starts at a high level of hysteresis and remains at that level as the temperature rises and hence is very susceptible to heat build-up. The hysteresis of rayon starts at a low level, but increases with temperature. Even at 300° F., however, its hysteresis loss is only about half that of cotton so that its heat build-up is much slower. Nylon has a hysteresis loss intermediate between cotton and rayon, but as the temperature rises nylon hysteresis falls. Thus the heat contribution of nylon under flexure gets smaller as the temperature rises, which contributes to greater high-temperature durability. This situation would be true even if nylon were not more stable chemically at elevated temperatures than the other two organic materials.

To summarize the effect of different cord materials in the changing tire situation, cotton is pretty much out of the running because rayon has excelled in performance and has enabled us to make a tire of at least equal cost.

Nylon has shown many superiorities, particularly with respect to high-temperature performance and resistance to impact bruising at all temperatures. Nevertheless, nylon's plastic characteristics and its tendency to shrink at the high temperatures of vulcanization have created some service problems which have not been completely solved, although I believe they are well on the way to solution. The outstanding obstacle to the use of nylon as a rather complete replacement for rayon is its cost, because, although we have adequate carcass strength when nylon is substituted for rayon on an equal cost basis, at the tensions imposed on the cords, under these conditions there is too much tire growth, cracking, and tendency for cord slippage.

As far as steel wire cords are concerned, there does not seem to be much prospect for making a passenger-car tire that would give the freedom from noise, road shock, and vibration which is required by the modern American automobile. European cars are stabilized differently, and it is quite possible that the use of steel tires may become more prevalent there.

Other Tire Performance Factors

With reference to tread wear resistance, much has already been done—first by prolonging the high tensile characteristics of the tread stock even after rather severe heat aging; second by better tread cracking inhibitors; and third by the tread contour and the shape of the tread pattern.

We have studied over a long period the possibility of using polyurethane rubber tread caps, but have been defeated so far by the inadequate bond between polyurethane and other rubber compounds. Now, with a satisfactory sulfur vulcanization system for polyure-

TABLE 8. CORD HYSTERESIS vs. TEMPERATURE
(10 CYCLES - 1/4% DEFL. - 3 LBS.)

| Temperature | Cotton | Rayon | Nylon |
|-------------|--------|-------|-------|
| Room | 35.6% | 8.3% | 24.7% |
| 300° F. | 35.3% | 18.9% | 6.7% |

thane rubber, these bonds are being improved, and we hope to make them adequate. By this means we can practically double the wear resistance which would permit us to use thinner treads. This practice would serve a double purpose of bringing the expensive polyurethane cost into line and reducing heat generation.

For a compound made from a given elastomer, tread wear results depend to a considerable degree on the dispersion of the reinforcing carbon blacks used. Various methods for improving this dispersion are being studied and some of them are being put into use. The possibilities of improvement in tread wear here are not so great as those from the use of polyurethane, being perhaps in the neighborhood of 20 to 30% but the application is much simpler.

In addition to the conventional wire tire, various "belted" tire constructions have been studied. These all depend for their tread wear improvement on a breaker structure which is relatively inextensible in the direction of the great circumference of the tire. Depending upon the nature of the construction and the type of material used, tread wear improvements have been experienced of from 45 to 85%. So far, however, none of these constructions has produced a tire with ride characteristics which are adequate.

Not too much has been said about the polymer selected for tire use. Because of the excellent wear characteristics of SBR, it has pretty much taken over the passenger-car tire treads market. It is not sufficiently resilient for high-speed truck tires, off-the-road tires, and some other types where heat generation is the most critical foe to tire life. As speeds continue to get higher, the heat generation and power consumption of the rubber get more important. We shall perhaps need to improve on the resilience of our present treads as we go along, and certainly it is important that we can get at least equal wear with thinner treads in the future.

It is realized that no rubber is ideal and that the balance of operating conditions changes from time to time; so we must make the best compromise we can with the materials at hand, rather than to focus our attention exclusively on one operating feature.

Car Engineering

There is an aspect of tire performance which does not have much to do with the tire life or safety, but which primarily affects the comfort of the passenger. This has to do with tire vibration transmitted to various parts of the car.

The highly resilient tire structure inflated with air, which is an elastic fluid, is easily excited by small impacts to vibrations in many different directions. It is

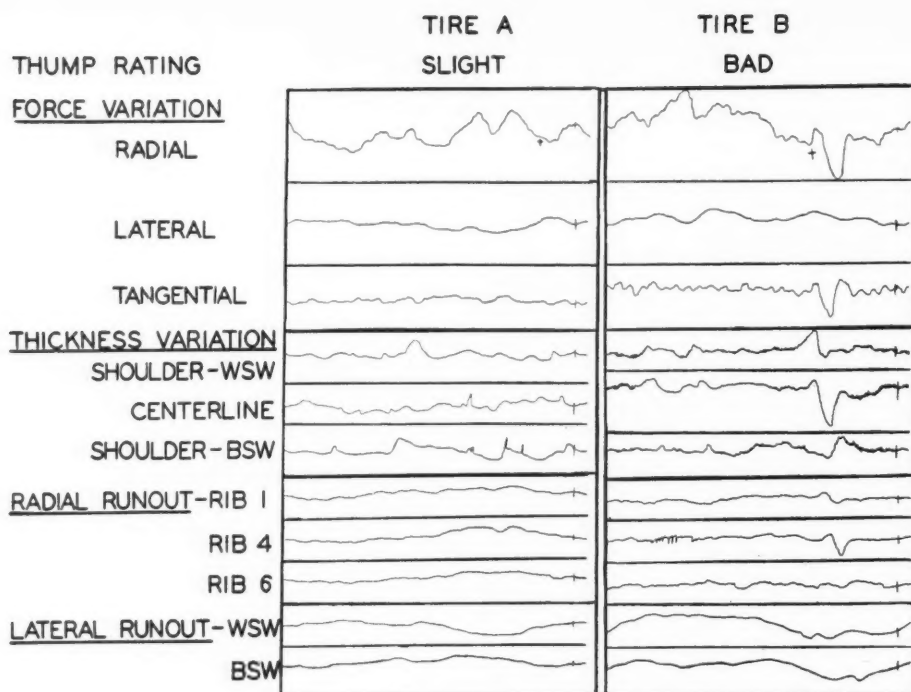


Fig. 6. Analysis of tire irregularities. Size, 7.10 by 15 DeLuxe Supercushion

unfortunate that basic frequencies frequently correspond with the frequencies of various portions of the automobile which act as amplifiers. Small irregularities in the tire, when it is rolling along at various speeds, will excite the tire to vibrations which may form beats in the fundamental frequency. If these beats are in a frequency range of four to eight cycles per second, there is a sensation similar to that of passing over a road joint, which is known as "thump." At higher frequencies, 10 to 15 cycles per second, the effect is known as "roughness" because human beings cannot detect the intervals by ear, and the sensation is rather one of an irregular vibration.

Figure 6 shows records obtained from the analysis of the irregularities of two tires. The left one is sufficiently regular to produce little vibration; while the right one has enough irregularity to produce severe thump and roughness. The top three curves in each case represent

variations in radial, lateral, and tangential forces when the inflated tire is loaded against a roller eight inches in diameter. The next three lines show thickness variations of the tire center lines, and the tread shoulders. The next three lines show variations in the tire radius and the bottom two show the lateral variations. The large irregularity at the right shown by the second tire is sufficient to produce a thump and possibly some roughness. It should not be assumed, however, that this type of irregularity is the only one to produce these phenomena. It is merely one of the easier ones to find.

Figure 7 shows a chart made by a vibration recording instrument in which the top curve was produced in a car driven at 37 miles per hour. This shows an overall roughness, but no repeated peaks of any outstanding character. The curve below was made at the same time, but all the vibrations below 17 per second and above 44 per second were filtered out. This shows up the peri-

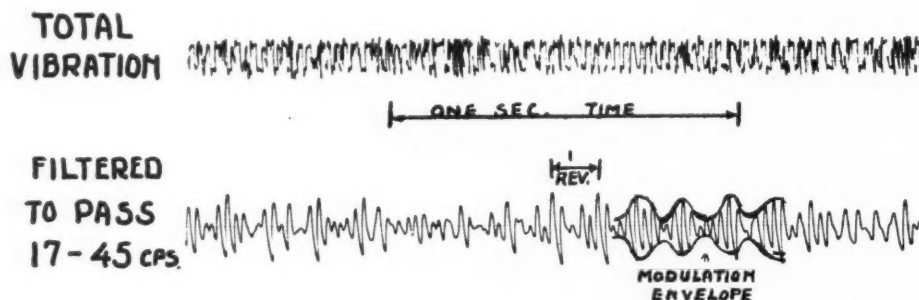


Fig. 7. Vibrations in car driven at 37 mph. Total vibration in upper chart; vibrations recorded in lower chart exclude those below 17 and above 44 cycles per second

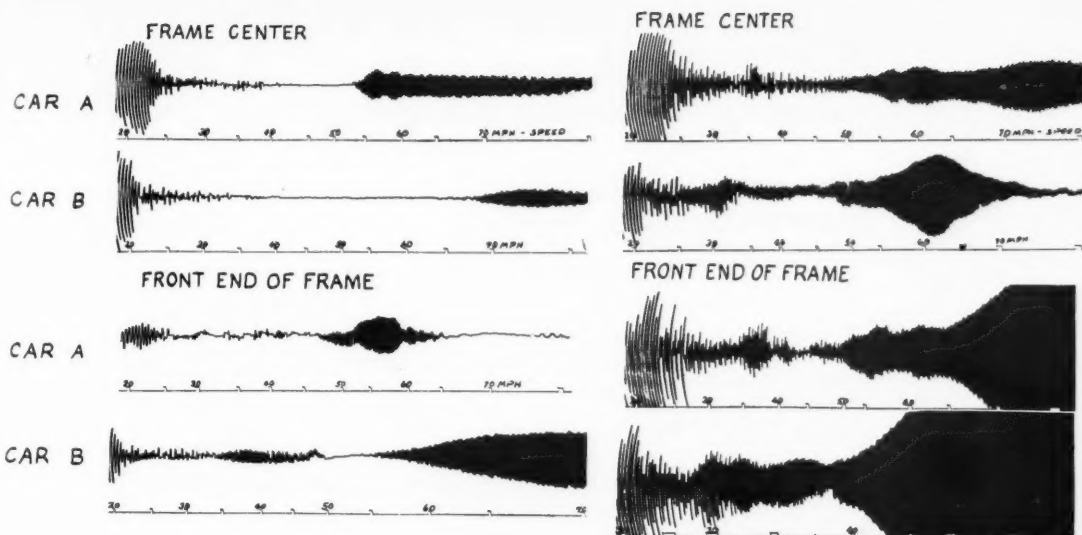


Fig. 8. Vibrations at wheel revolution frequencies for cars A and B accelerated from 20 to 70 mph. Lateral shake produced is shown on left, and vertical shake on right

odic beats which we classify as "thump."

It is interesting to note that the same set of tires produces different results on different cars. Figure 8 shows the vibrations at wheel revolution frequencies which occur as the car is gradually accelerated from 20 miles per hour to 70 miles per hour. Car A is more sensitive to lateral shake than car B in the 50- to 60-mph. range. Car B is more sensitive to vertical shake in the 50-mph. range. These results show that although tires are often the source of the vibration initiation, different cars will respond differently to the same vibration source.

Many attempts have been made to introduce into the construction of tires features which would scramble the vibrations in such an irregular manner that they would not produce the beats which are so objectionable. Some success has been achieved with random spacing of the blocks which constitute the tread pattern, but practically no success has been obtained otherwise. To date, the best effects which can be obtained by the tire manufacturer are from rigid elimination of large irregularities. These may range all the way from tread thickness and cord tensions to bead positions. The car manufacturer has done much to reduce vibration in recent models. He will probably do more in the future as we all learn more about what vibrations are most objectionable to the car driver and how they are transmitted.

Summary and Conclusions

The increased speed and maneuverability of the modern automobile have brought new and severe problems to the tire engineer. These problems have been enhanced by the rapid growth of our turnpike and freeway system, which permits sustained high-speed driving. The average driver is deceived by the comfort, quietness, and ease of handling of his car and does not

realize that his driving habits have changed to include more high-speed driving, more severe braking and acceleration, and faster negotiation of curves. The effect of these several new factors on tire life is very serious, particularly when augmented by high-tire temperatures which may arise from high ambient temperature, internal heating of the tire at high speeds, or a combination of both.

The cord materials and rubber compounds used in today's tires are weakened by the elevated temperatures produced during high-speed turnpike driving. Although nylon tire cord has shown many superiorities over rayon cord, the obstacle to the complete replacement of rayon by nylon is its cost. The most resistant tire cord material is steel wire, but a passenger-car tire made with wire cord would not give the freedom from noise, road shock, and vibration which is required by the driver of the modern American automobile.

Driving moderation is essential for both safety and long tire life. The tire engineer, however, is doing a good job of using the best combinations of materials available to produce tires to give the best and safest performance under present-day service demands.

The modern, quieter-running automobile is a sounding board for vibrations excited by the tires. Irregularities in the tires, some of which may be found by methods available to the tire engineer and some of which may not, may produce beats in the fundamental frequencies which are audible and objectionable or may be noticed chiefly in shake and vertical vibration of the car. These effects vary not only with tires, but with cars.

A positive cure for these vibration troubles has been sought for some time, but without complete success. Continued study of the causes and close cooperation between car manufacturers and tire engineers will be necessary to keep pace with the continually increasing standards of the motoring public.

Surface Embrittlement Of Mineral-Filled SBR Polymers¹

By W. F. ABBEY, R. T. ZIMMERMAN, W. H. CORNELL

R. T. Vanderbilt Co., Inc., New York, N. Y.

Surface embrittlement of mineral-filled styrene-butadiene rubber (SBR) compounds has been found to be related to the type of polymer used, the type antioxidant, and how the antioxidant is introduced into the compound, that is, during polymerization or compounding.

The most resistant polymer is SBR 1001, and amine-type antioxidants are superior to the hindered phenol types and the alkyl aryl phosphite types.

WHEN mineral-filled styrene-butadiene rubber (SBR) vulcanizates age, either in the sunlight or in the absence of it, they sometimes develop an embrittled, lacquer-like surface which cracks readily when the vulcanizate is bent. This condition usually occurs in clay and whiting loaded, non-staining polymer-type recipes where the polymer contains either a hindered phenol or an alkyl aryl phosphite stabilizer.

Since this embrittlement takes some months to develop under natural conditions, it was necessary to choose a laboratory test that would develop the condition rapidly in order to study the problem. The seven-day oxygen bomb aging test (80° C. and 300 psi. oxygen) was chosen because it was sensitive to small compounding changes and because the surface developed on the test specimens seemed representative of the embrittlement developed by commercial vulcanizates in service.

Amine type antioxidant in the amount of 1.5 parts on 100 of polymer added during polymerization is more effective than when added as a compounding ingredient.

Copper bearing accelerators can be used safely in mineral-filled SBR recipes if adequate stabilization is provided either in the SBR polymer or by introducing additional stabilizers to the recipe or both.

The first approach used in the study of this problem was an examination of the various slightly staining and non-staining polymers generally used in this type of compounding. A bale of each of the polymers used was obtained from suppliers of the several polymers investigated and as such was considered to be representative of commercial production.

Polymers Investigated

Table 1 shows a list of the SBR elastomers investigated. These are listed in the decreasing order of their resistance to embrittlement. An attempt was made to correlate the resistance of the elastomers to surface embrittlement with some feature used in the manufacture of that polymer. We deduced from our data that

¹ Presented before the Division of Rubber Chemistry, ACS, New York, N. Y., Sept. 11, 1957.

TABLE 1. RELATIVE EMBRITTLEMENT RESISTANCE OF VARIOUS SBR ELASTOMERS IN STANDARD TEST RECIPE AFTER O₂ BOMB AGING

| SBR No. | Bound Styrene, % | Emulsifier | Catalyst | Polym. Temp., °F. | % Conversion | Shortstop | Stabilizer | Coagulation |
|---------|------------------|------------|----------|-------------------|--------------|--------------|--------------------------|-------------|
| 1001 | 23.5 | NaFA | P | 122 | 68 | Hydroquinone | Octylated diphenyl-amine | SA |
| 1502 | 23.5 | RA/FA | OHP | 41 | 60 | Carbamate | Styrenated phenol | SA |
| 1006 | 23.5 | NaFA | P | 122 | 72 | Carbamate | Styrenated phenol | SA |
| 1022 | 23.5 | RA | P | 125 | 72 | Hydroquinone | Alkyl aryl phosphite | GA |
| 1019 | 23.5 | FA | P | 122 | 72 | Hydroquinone | Alkyl aryl phosphite | GA |
| 1503 | 23.5 | FA | OHP | 41 | 77 | Carbamate | Alkyl aryl phosphite | GA |
| 1018 | 23.5 | FA | OHP | 125 | 77 | Hydroquinone | Alkyl aryl phosphite | GA |
| 1504 | 12.0 | FA | OHP | 41 | 60 | Carbamate | Alkyl aryl phosphite | GA |

FA—fatty acid.
NaFA—sodium fatty acid.
RA—rosin acid.

P—persulfate.
OHP—organic hydroperoxide

SA—salt acid.
GA—glue acid.



W. F. ABBEY



R. T. ZIMMERMAN



W. H. CORNELL

The Authors

W. F. Abbey, assistant laboratory manager, R. T. Vanderbilt Co., East Norwalk, Conn., received his B.S. in chemical engineering from Pennsylvania State University in 1941. He was employed by the Firestone Tire & Rubber Co., Akron, O., from 1941 until 1946 and was chief chemist of the Firestone Pottstown, Pa., plant from 1946 until 1950. He joined R. T. Vanderbilt Co. in 1950 and has held his present position since 1955.

Mr. Abbey is a member of the American Chemical Society and its Rubber Division and the New York and Connecticut Rubber Groups.

R. T. Zimmerman, in charge of the dry rubber division at the Vanderbilt laboratory, obtained his B.S. in chemical engineering from Purdue University in 1931, where he also did graduate work. He also took courses at Akron U.

Mr. Zimmerman was employed as a rubber

chemist by Firestone in Akron from 1934 until 1939, and in Noblesville, Ind., from 1939 until 1943. He came to Vanderbilt in 1943 and has held his present position since that time.

He is a member of the A.C.S. and its Rubber Division and the New York and Connecticut Rubber Groups and is chairman of the latter Group at the present time.

W. H. Cornell is a graduate of Ironton High School, Ironton, O. He was employed by Henrite Products, Inc., from 1940 until 1942, and from 1946 until 1952. He joined Marbon Chemical Division, Borg-Warner Corp., in 1952 as a group leader in product development and remained with that organization until joining Vanderbilt in 1956.

Mr. Cornell is an associate member of the Rubber Division, A.C.S., and of the New York and Connecticut Rubber Groups.

while polymerization temperature, % conversion, the catalyst, the shortstop agent, and the emulsification system may have influenced the ability of the polymer to resist surface embrittlement in this study, the stabilization of the polymer and the method of coagulation had definite significant effects overshadowing the anomalies that were shown by the other polymerization factors.

We found that the salt-acid coagulated polymers are somewhat more resistant than the glue-acid coagulated polymers. We found also that the octylated diphenylamine stabilized SBR 1001 polymer is superior to all polymers tested in resistance to embrittlement. We found, furthermore, that styrenated phenol stabilized SBR 1502 polymer is superior to alkylated aryl phosphite stabilized polymers.

Table 2 shows the manufacturing features of the two polymers most resistant to the surface embrittlement condition. SBR polymer 1001, persulfate catalyzed, 68% converted, hydroquinone shortstopped, amine stabilized, and salt-acid coagulated, is the most resistant polymer of those examined. This is a so-called hot

rubber polymerized at about 122° F. SBR 1502, a hydroperoxide catalyzed, 60% converted, carbamate shortstopped, styrenated phenol stabilized, salt-acid coagulated polymer, is the second most resistant polymer studied in our work. SBR 1502 is a 41° F. polymerized elastomer.

Table 3 lists the test recipe employed for the comparison of these polymers. It is a 100-part Dixie Clay recipe accelerated with 1.5 parts Altax and 0.25-part Methyl Cumate and contains 2.0 parts sulfur. This is

TABLE 2. SBR POLYMERS MOST RESISTANT TO EMBRITTLEMENT

| Polymer | 1001 | 1502 |
|-----------------|--------------|---------------|
| Catalyst | Persulfate | Hydroperoxide |
| Conversion | 68% | 60% |
| Shortstop | Hydroquinone | Carbamate |
| Stabilizer type | Amine | Phenolic |
| Coagulation | Salt acid | Salt acid |

not a commercial recipe. It is a simple recipe designed with a minimum of ingredients in order to obtain the maximum effect from single variable studies. It is highly accelerated in order to develop a high state of cure which would tend to aid in the development of the surface condition being investigated.

TABLE 3. TEST RECIPE

| | |
|----------------|--------|
| SBR polymer | 100.00 |
| Zinc oxide | 5.00 |
| Stearic acid | 2.00 |
| Dixie Clay* | 100.00 |
| Sulfur | 2.00 |
| Altax† | 1.50 |
| Methyl Cumate‡ | 0.25 |

* Aluminum silicate filler.

† Benzothiazyl disulfide.

‡ Copper dimethyl dithiocarbamate.

Table 4 shows the original and oxygen bomb aged properties for each polymer when compounded into the test recipe shown in the previous figure. These specimens were cured 15 minutes @ 307° F., which was about optimum from a physical property standpoint. Aging was conducted in individual oxygen bombs, which were isolated to prevent any possible migration.

TABLE 4. COMPARISON OF POLYMERS

| SBR Polymer | 15-Minute Cure | | | |
|-------------|---------------------|-------------------|--------------------------|-------------------|
| | Original Properties | | 7-Day Oxygen Bomb—80° C. | |
| | Elong., % | Hardness, Shore A | Elong., % | Hardness, Shore A |
| 1001 | 660 | 65 | 430 | 71 |
| 1502 | 650 | 66 | 300 | 75 |
| 1006 | 600 | 66 | 30 | 91 |
| 1022 | 430 | 64 | 30 | 87 |
| 1019 | 630 | 65 | 0 | 92 |
| 1503 | 580 | 66 | 0 | 93 |
| 1018 | 510 | 67 | 30 | 81 |
| 1504 | 610 | 67 | 20 | 87 |

It is apparent that both the SBR 1001 and SBR 1502 recipes retain a substantial percentage of their original elongation after O₂ bomb aging. The SBR 1001 recipe has hardened six points and the SBR 1502 recipe has hardened nine points. Neither of these recipes show any surface embrittlement. All of the other recipes are severely embrittled, and these specimens are no longer elastomeric. They exhibit the hard, shiny, lacquer-like surface so typical of embrittlement.

Table 5 shows the same type of data for the 25-minute cure. Again the elongation and hardness figures of the original vulcanizates are shown, compared with the seven-day oxygen bomb at 80° C. elongation and hardness figures. The SBR 1001 recipe increased in hardness from 66 to 74 and decreased in elongation from 610 to 340%. The specimens showed no surface

embrittlement whatever. The SBR 1502 has increased this time from 66 hardness to 90. It has become quite short, having an ultimate elongation after oxygen bomb aging of only 40%. In this instance the surface was quite embrittled, and the test specimens broke readily. The balance of the recipes containing the other polymers all showed surface embrittlement. It is apparent from these data that the SBR 1001 polymer stabilized with octylated diphenylamine is the only polymer which successfully resisted the development of surface embrittlement at both cures.

TABLE 5. COMPARISON OF POLYMERS

| SBR Polymer | 25-Minute Cure | | | |
|-------------|---------------------|-------------------|--------------------------|-------------------|
| | Original Properties | | 7-Day Oxygen Bomb—80° C. | |
| | Elong., % | Hardness, Shore A | Elong., % | Hardness, Shore A |
| 1001 | 610 | 66 | 340 | 74 |
| 1502 | 590 | 66 | 40 | 90 |
| 1006 | 590 | 67 | 20 | 91 |
| 1022 | 380 | 65 | 20 | 89 |
| 1019 | 580 | 66 | 0 | 93 |
| 1503 | 580 | 68 | 0 | 93 |
| 1018 | 460 | 68 | 20 | 84 |
| 1504 | 580 | 68 | 40 | 87 |

Antioxidant Study

The next approach to the study of this problem was the addition of antioxidants to a recipe which was known to embrittle. The same 100-part Dixie Clay, 1.5-part Altax, 0.25-part Methyl Cumate, 2.0-part sulfur recipe was used. SBR 1503 was chosen as the polymer to be used since it embrittled readily in the polymer comparison work. To this recipe 1.5 parts of each Vanderbilt antioxidant were added without regard to their staining or discoloring tendencies.

Table 6 lists the aged properties of specimens from the SBR 1503 recipe containing 1.5 parts of each of

TABLE 6. ANTIOXIDANT COMPARISON IN SBR 1503

| Agerite Antioxidant | Dosage 1.5 Parts/100 RHC | | |
|---------------------|-----------------------------------|------------------------|-----------------|
| | 7-Day Oxygen Bomb—80° C.—300 Psi. | | |
| | Press Cure @ 307° F. | Elongation Retained, % | Actual Hardness |
| Alba | 15' | 71 | 67 |
| | 25' | 49 | 69-SH |
| Gel | 15' | 65 | 67 |
| | 25' | 8 | 74-SH |
| Spar | 15' | 0 | 93-SH |
| | 25' | 0 | 93-SH |
| Stalite | 15' | 65 | 67 |
| | 25' | 21 | 71-SH |
| Superlite | 15' | 47 | 68 |
| | 25' | 0 | 86-SH |

NOTE: SH indicates surface hardening.

the antioxidants shown. The data are presented as actual measured hardness and percentage of original elongation retained at both the 15- and 25-minute at 307° F. cures.

Agerite Alba, hydroquinone monobenzyl ether, prevents embrittlement at the 15-minute-cure. The 25-minute-cure specimens, however, do show signs of embrittlement even though the hardness has increased only a few points.

Agerite Gel, a blend of octylated diphenylamine with a microcrystalline wax, prevents embrittlement at the 15-minute-cure also. The 25-minute-cure specimens, however, are embrittled.

Agerite Spar, styrenated phenol, is completely ineffective at both cures when used in this manner, that is, as a compounding ingredient. You will recall, however, that SBR 1502, which is stabilized with styrenated phenol at the time of manufacture, did show some resistance to surface embrittlement. We conclude that the stabilizer is more effective when added at the time of polymer manufacture than when it is added as a compounding ingredient.

Agerite Stalite, octylated diphenylamine, prevents embrittlement of the 15-minute-cure specimens. The 25-minute-cure specimens show signs of embrittlement. It will be shown by subsequent data that a minimum of 2.0 parts of Agerite Stalite is required to prevent embrittlement of this SBR 1503 recipe completely at both cures.

Agerite Superlite, a hindered phenol of undisclosed composition, prevents embrittlement of the 15-minute-cure specimens. The 25-minute-cure specimens were severely embrittled.

Thus octylated diphenylamine and hydroquinone monobenzyl ether showed promise for the prevention of the surface hardening condition. The hindered phenols were not so effective, and, indeed, the styrenated phenol was completely ineffective.

Table 7 shows the aged properties of specimens from the SBR 1503 recipe to which 1.5 parts of the staining antioxidants were added.

Both Agerite Hipar, mixed phenyl beta naphthylamine-isopropoxy diphenylamine and diphenyl para-

phenylenediamine, and Agerite HP, mixed phenyl beta naphthylamine and diphenyl paraphenylenediamine, are completely effective at both cures.

Agerite Powder, phenyl beta naphthylamine, prevents embrittlement of the 15-minute-cure specimens, but the 25-minute-cure specimens show signs of embrittlement.

Agerite Resin D, polymerized trimethyl dihydroquinoline, is effective in preventing embrittlement of the 15-minute-cured specimens. The 25-minute-cure specimens, however, are severely embrittled.

Agerite White, symmetrical dibeta naphthylparaphenylenediamine, is completely effective at both cures.

Thus it appears that the amine-type antioxidants are quite effective for the stabilization of mineral-filled SBR recipes against surface embrittlement.

Cu vs. Non-Cu Accelerators with Stalite

There have been reports that this surface embrittlement condition is caused by the use of a copper accelerator. It has been shown here that Agerite White, an excellent copper deactivator, prevents the development of surface embrittlement. It is interesting to note also, however, that both Agerite Hipar and HP prevent the surface hardening, and neither of these antioxidants is generally considered to be a strong copper deactivator in normal dosages.

The use of certain amine-type antioxidants in light-colored compounds would, of course, be impractical because of the discoloration caused by most amine-type antioxidants. The one slightly staining, slightly discoloring antioxidant which showed merit was octylated diphenylamine, Agerite Stalite. We, therefore, determined to try Agerite Stalite at 2.0 parts per 100 of polymer since we did get some embrittlement at 1.5 parts in the SBR 1503 recipe.

Table 8 shows the base recipe used for a comparison of Methyl Cumate and Methyl Zimate in a clay-loaded SBR 1503 recipe. Two parts of Agerite Stalite have been added since some embrittlement was observed in previous trials at 1.5 parts.

Table 9 shows that 0.25-part Methyl Cumate has been added to the first compound, and 0.5-part of Methyl Zimate has been added to the second compound. The Mooney scorch figures are typical for Altax-Methyl Cumate versus Altax-Methyl Zimate recipes

TABLE 7. ANTIOXIDANT COMPARISON IN SBR 1503
Dosage 1.5 Parts/100 RHC
7-Day Oxygen Bomb—80° C.—300 Psi.

| Agerite Antioxidant | Press Cure @ 307° F. | Elongation Retained, % | Actual Hardness |
|---------------------|----------------------|------------------------|-----------------|
| Hipar | 15' | 67 | 67 |
| | 25' | 67 | 68 |
| HP | 15' | 66 | 68 |
| | 25' | 69 | 68 |
| Powder | 15' | 76 | 67 |
| | 25' | 61 | 69-SH* |
| Resin D | 15' | 55 | 70 |
| | 25' | 0 | 85-SH* |
| White | 15' | 66 | 69 |
| | 25' | 66 | 69 |

* Surface hardening.

TABLE 8. BASE COMPOUND—CUMATE vs. ZIMATE STALITE ANTIOXIDANT

| | |
|-----------------|-------|
| SBR 1503 | 100.0 |
| Stearic acid | 2.0 |
| Zinc oxide | 5.0 |
| Dixie Clay | 100.0 |
| Agerite Stalite | 2.0 |
| Altax | 1.5 |
| Sulfur | 2.0 |
| | 212.5 |

in that the lower dosage of Methyl Cumate, being moderated by the 1.5 parts Altax in the base recipe, has a Mooney scorch of 32 minutes, and the Methyl Zimate recipe, on the other hand, has a Mooney scorch of about 17 minutes. The original properties show quite clearly that the Cumate recipe is much faster curing even though it is less scorchy, and we note optimum properties measured by modulus, elongation, and hardness at the 15-minute cure level. With the Methyl Zimate recipe, however, we get just about the same set of properties at the 30-minute cure.

TABLE 9. CUMATE vs. ZIMATE—ORIGINAL PROPERTIES

| | | | | | | |
|---------------------|-------------------------|---------------------------|-----------------------|----------------|--------------|---------------------------|
| 212.50 | Base compound | 212.50 | | | | |
| 0.25 | Methyl Cumate | — | | | | |
| — | Methyl Zimate* | 0.50 | | | | |
| 32 min. | Mooney scorch @ 250° F. | 17 min. | | | | |
| Original Properties | | | | | | |
| | | | | | | |
| Tens., Psi. | Elong., % | Hard- ness, Shore A | 307° F. Cure, Min. | Tens., Psi. | Elong., % | Hard- ness, Shore A |
| 980 | 670 | 64 | 15 | 730 | 830 | 60 |
| 1090 | 610 | 65 | 20 | 840 | 780 | 62 |
| 1050 | 610 | 65 | 30 | 970 | 720 | 64 |

* Zinc dimethyl dithiocarbamate.

TABLE 10. CUMATE vs. ZIMATE—AGED PROPERTIES

| | | | | | | |
|---|---------------|--------------------------|-----------------------|----------------|--------------|--------------------------|
| 212.50 | Base compound | 212.50 | | | | |
| 0.25 | Methyl Cumate | — | | | | |
| — | Methyl Zimate | 0.50 | | | | |
| 7-Day O ₂ Bomb—80° C.—300 Psi. | | | | | | |
| | | | | | | |
| Tens., Psi. | Elong., % | Hard- ness Shore A | 307° F. Cure, Min. | Tens., Psi. | Elong., % | Hard- ness Shore A |
| 1540 | 390 | 70 | 15 | 1450 | 490 | 68 |
| — | 220 | 71 | 20 | 1500 | 470 | 69 |
| — | 120 | 74 | 30 | 1560 | 420 | 70 |

If we compare the aged properties as shown in Table 10, we see that the Methyl Cumate compound at the 15-minute cure, which we took as optimum, shows an increase to a hardness of 70 and an aged elongation of 390%. On the overcure the compound becomes quite short. For the 100% overcure we have about 120% elongation. The Methyl Zimate compound, on the other hand, retained good modulus, elongation, and hardness characteristics and showed no evidences of surface embrittlement. Please bear in mind that the Methyl Cumate compound showed no surface embrittlement either. This is in an SBR 1503 recipe to which 2.0 parts of Agerite Stalite have been added.

No Added Antioxidant

The next trial that was made utilized the most resistant polymer, SBR 1001, without any added anti-

oxidant at all. The test recipe shown in Table 11 is identical with the others except that SBR 1001 is the polymer. *There is no added antioxidant.*

TABLE 11. BASE COMPOUND—NO ANTIOXIDANT—TEST RECIPE

| | |
|--------------|-------|
| SBR 1001 | 100.0 |
| Zinc oxide | 5.0 |
| Stearic acid | 2.0 |
| Dixie Clay | 100.0 |
| Altax | 1.5 |
| Sulfur | 2.0 |
| | 210.5 |

TABLE 12. CUMATE vs. ZIMATE—NO ADDED ANTIOXIDANT

| | | |
|---------|-------------------------|---------|
| 210.5 | Base compound | 210.5 |
| 0.25 | Methyl Cumate | — |
| — | Methyl Zimate | 0.5 |
| 33 min. | Mooney scorch @ 250° F. | 17 min. |

Original Properties

| Tens., Psi. | Elong., % | Hard- ness Shore A | 307° F. Cure, Min. | Tens., Psi. | Elong., % | Hard- ness Shore A |
|----------------|--------------|--------------------------|-----------------------|----------------|--------------|--------------------------|
| 620 | 780 | 59 | 10 | 450 | 590 | 51 |
| 690 | 710 | 61 | 15 | 590 | 720 | 55 |
| 750 | 670 | 63 | 25 | 690 | 740 | 59 |

TABLE 13. CUMATE vs. ZIMATE—NO ADDED ANTIOXIDANT—AGED PROPERTIES

| | | | | | | |
|---|---------------|--------------------------|-----------------------|----------------|--------------|--------------------------|
| 210.5 | Base Compound | 210.5 | | | | |
| 0.25 | Methyl Cumate | — | | | | |
| — | Methyl Zimate | 0.5 | | | | |
| 7-Day O ₂ Bomb—80° C.—300 Psi. | | | | | | |
| | | | | | | |
| Tens., Psi. | Elong., % | Hard- ness Shore A | 307° F. Cure, Min. | Tens., Psi. | Elong., % | Hard- ness Shore A |
| 1000 | 430 | 65 | 10 | 910 | 540 | 63 |
| 990 | 420 | 68 | 15 | 990 | 480 | 65 |
| 1170 | 390 | 69 | 25 | 1030 | 420 | 67 |

Again, to this base compound 0.25-part Methyl Cumate and 0.5-part Methyl Zimate were added as shown in Table 12. These scorch figures are typical of the thiazole moderated Cumate *versus* the thiazole moderated Zimate SBR recipe. The lower dosage of Cumate with the Altax results in a 33-minute Mooney scorch value at 250° F.; whereas, the Methyl Zimate has a scorch value of 17 minutes. The original properties again reveal that at the 10-minute-at-307° cure the Cumate compound is about equivalent to the 25-minute-at-307° cure for the Zimate compound.

(Continued on page 264)

A New Apparatus for Determining the Cell Structure of Cellular Materials¹

By W. J. REMINGTON and R. PARISER

E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

Many of the applications of cellular materials, both flexible and rigid, depend upon the ability to control the cell structure of these materials, mainly the percentage of open or closed cells.

A new apparatus for determining the volume

percentage of open and closed cells in both rigid and flexible foams has been developed. The test takes only a few minutes and requires only three simple calculations. It has been used, with many types of rubber and plastics foams.

CELLULAR materials, both flexible and rigid, are finding wide acceptance in cushioning, insulation, and structural fields. Many of these applications depend upon the ability to control the cell structure of these materials, mainly the percentage of open or closed cells in the foam. For example, flexible foams intended for use as cushioning require a preponderance of interconnecting cells for maximum resilience and comfort. In other applications, a high percentage of closed cells is desirable for higher load bearing capacity at a given foam density. The capacity to absorb impact is also influenced by the content of closed cells in a foam. The ability of rigid foams to serve effectively as thermal insulation and to resist moisture vapor transmission is dependent to a large extent upon a closed cell structure.

Water or solvent absorption during immersion has been used as a means of determining foam cell structure, but the method has several disadvantages. A period of days or weeks is necessary for the absorption to reach equilibrium. Organic solvents may exhibit a swelling effect on some foams, thereby influencing the absorption data.

The method described provides a means of determining the percentage of open and closed cells in both rigid and flexible cellular materials by the displacement of air. The test requires only a few minutes, and treatment of the data is extremely simple.

The apparatus measures the volume of air displaced when a foam specimen is placed into a closed chamber. The volume of displaced air represents the space occupied by the closed cells plus the cell walls in the foam. The apparatus contains two confined chambers of air at equal pressure and volume and separated from each other by a manometer. The foam sample is placed into one of these chambers. An indication of the volume of air displaced by the specimen is obtained by imposing a slight vacuum on both systems and noting the resultant pressure differential on the manometer. The actual volume of displaced air is determined by reducing the volume of air in the reference chamber until the

two systems are of equal pressure. Since the specimens are subjected to only a very slight vacuum, errors which are due to cell distortion are considered to be insignificant.

Description of Apparatus

The apparatus, as shown in Figure 1, consists essentially of a sample chamber connected through two manometers in parallel to a reference chamber provided with a gas burette and a mercury leveling bulb. One of the manometers connecting the two systems also has a mercury leveling bulb. The second or auxiliary manometer contains dibutyl phthalate.

The sample chamber system includes the sample chamber (A), left half of the mercury manometer (B), and left half of the auxiliary manometer (C). The total volume of air contained in this system is referred to as V_1 .

The reference chamber system includes bulb (E), auxiliary bulb (J), right half of the mercury manometer (B), right half of auxiliary manometer (C), and the gas burette (D). The total volume of air contained in this system is referred to as V_2 .

The sample chamber (A) is designed to contain a maximum sample volume of three cubic inches. The gas burette (D) and mercury leveling bulb (K) are used to determine the volume of air displaced from the sample chamber by the introduction of the foam specimens. The calibrated auxiliary bulb (J) is required when measuring foams containing greater than 65% closed cells. It is used to reduce the volume of air in the reference chamber when the volume of displaced air in the sample chamber exceeds the capacity of the 25-milliliters gas burette. This is done by closing stop-cock (H).

The mercury manometer (B) connects the sample and reference chambers and is used to apply a slight vacuum to the two systems so that differences in pressure may be detected. A second manometer (C), containing dibutyl phthalate is connected in parallel with the mercury manometer and is used for greater sensitivity in detecting pressure differential.

¹Presented before the Division of Rubber Chemistry, ACS, New York, N. Y., Sept. 12, 1957.

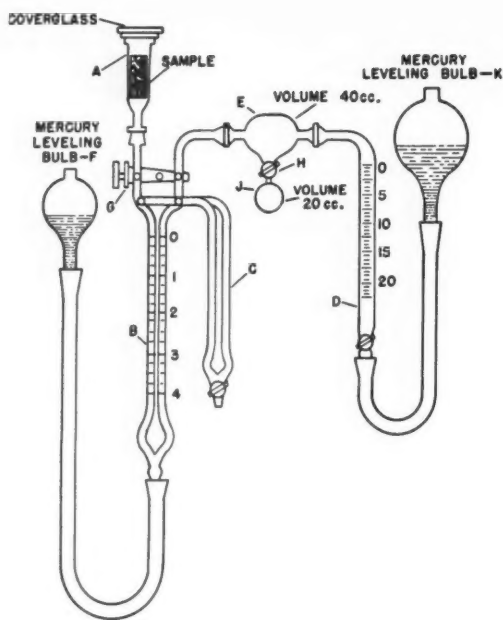


Fig. 1. Assembled apparatus for determining cell structure of foamed materials

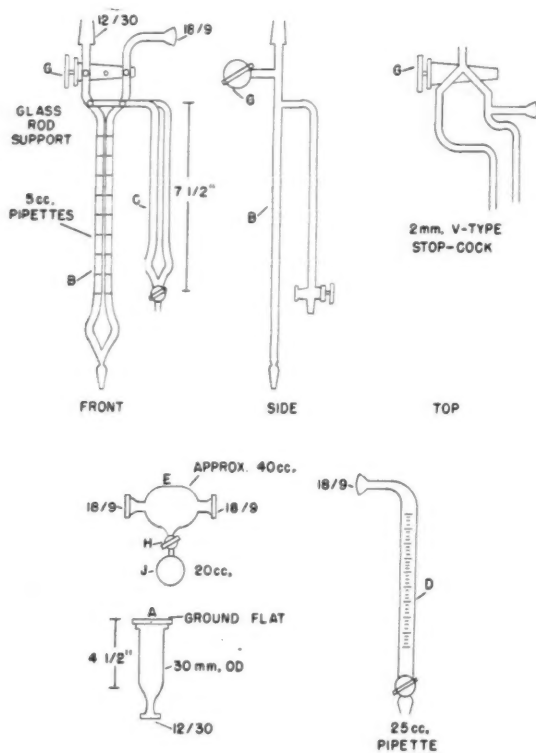


Fig. 2. Individual parts of apparatus for determining cell structure

The individual parts of the assembly are shown in Figure 2. Care should be taken in assembling the parts that all glass joints are properly sealed and clamped together.

Test Specimens

Specimens may be of irregular shape provided that the foam density is known. It is most convenient, however, to use a cylindrical specimen 1.129 inches in diameter and two to three inches high. Several smaller specimens of equivalent total volume may be used, but this will expose more surface area per unit volume and thus increase the percentage of open cells. Foam having an impervious skin on one or more surfaces will show a higher percentage of closed cells than foams with cut surfaces. Specimens should be weighed to the nearest 0.01-gram, and the geometric volume determined by measurement. If the specimens are irregular in shape, the volume may be calculated by dividing the weight by the foam density.

Test Procedure

Balancing the Volume of the Two Systems

The volume of air in the two systems is fixed by the following procedure. The sample chamber is sealed with a cover glass, and the mercury level in manometer (B) is brought to the zero position, with stopcock (G) open to the atmosphere. At the same time the mercury level in the gas burette is set at about 20 milliliters. The volumes of air at atmospheric pressure in both systems are then isolated by closing stopcock (G). During this operation stopcock (H) should remain open to include the auxiliary bulb (J) as part of the reference volume (V_2).

To determine whether the two systems are in balance, the mercury level in manometer (B) is lowered to approximately two milliliters by lowering the leveling bulb (F), thereby increasing the volumes of both chambers and decreasing the pressure correspondingly. If the levels of the liquid in both arms of the manometer (C) remain equal, it indicates that volumes V_1 and V_2 are equal. The mercury reading in burette (D) may then be used as a reference R_1 . If, however, the liquid level in the right arm (reference side) of manometer (C) is lower than that in the left arm (sample side), it indicates that V_2 is greater than V_1 ; so the level of the mercury in the burette must be raised to decrease V_2 . Conversely, if the liquid level in the right arm of manometer (C) is higher than that in the left arm, it indicates that the mercury level in the burette must be lowered to increase V_2 . Caution: these adjustments in the burette should be made only after the mercury level in manometer (B) has been brought back to zero, and with stopcock (G) open to the atmosphere.

With the burette at its new setting, the apparatus is again checked for balance as before. When the two systems have been balanced, that is, when no pressure differential can be detected on the manometer (C), then volumes V_1 and V_2 are equal. The mercury level in the burette is used as the reference R_1 .

Measuring the Foam Cell Structure

The specimen of known weight and volume is placed into the sample chamber (A), and the chamber again sealed off with a cover glass. A metal stirrup-type hanger

is used for inserting and holding the specimens. (The empty hanger should be left in the sample chamber during the balancing operation described in the previous section.) The systems are again brought into balance by the same series of steps as described above. When the two systems are in balance, the mercury level in the gas burette is recorded as R_2 .

$R_1 - R_2 = \Delta V$, the volume of air displaced by the foam specimen.

Measuring Foams of High Closed-Cell Content

Foams of high closed-cell content will displace a greater volume of air than those containing fewer closed cells. Consequently, it will be necessary to remove a greater volume of air from the reference chamber in order to balance the two systems. Foams containing more than 65% closed cells may displace more air from the sample chamber than can be displaced from the reference chamber by means of the 25-milliliter burette. A larger volume can be readily removed from the reference chamber by closing off the calibrated bulb (J) with stopcock (H). The volume of this bulb (20 milliliter) should be added to the reference reading R_1 . The equation then becomes:

$$R_1 + 20 - R_2 = \Delta V$$

Since the determination depends upon the measurement of air volumes, it is advisable to conduct the tests in a constant temperature room which is free from drafts. It is also necessary to avoid temperature changes in the apparatus such as might be induced by handling parts of the two glass chambers.

Calculations

The basic data which are needed are listed below:

Geometric volume of specimens
Weight of specimens
Specific gravity of the polymer
 $R_1 - R_2 = \Delta V$

From these data it is possible to calculate the volume % of the foam occupied by closed cells, open cells, and the cell walls.

1. Volume % occupied by closed cells =

$$\frac{\Delta V - \left(\frac{\text{Weight of specimen, g.}}{\text{specific gravity of polymer}} \right)}{\text{Volume of specimen, cc.}} \times 100$$

2. Volume % occupied by cell walls =

$$\frac{\text{Weight of specimen, g.}}{\text{Sp. gr. of polymer} \times \text{volume of specimen, cc.}} \times 100$$

3. Volume % occupied by open cells =

$$\frac{(\text{Volume of specimen, cc.}) - \Delta V}{(\text{Volume of specimen, cc.})} \times 100$$



W. J. Remington

R. Pariser

The Authors

W. J. Remington, research chemist, elastomer chemicals department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., received his B.S. degree in chemistry from the University of South Carolina in 1932 and his Ph.D. in chemistry from Ohio State University in 1937.

Dr. Remington was an Industrial Fellow at the Mellon Institute of Industrial Research from 1937 to 1946. He joined Du Pont in 1946 and shared in the development of Hypalon synthetic rubber. More recently he has been working on urethane foams.

This author is a member of the American Chemical Society, Sigma Xi, and the subcommittee on rigid cellular materials of the Society for the Plastics Industry.

R. Pariser, research supervisor, Du Pont elastomer chemicals department, obtained his B.S. degree in chemistry from the University of California in 1944 and his Ph.D. in chemistry from the University of Minnesota in 1950.

Dr. Pariser joined Du Pont in 1950 in the organic chemicals department. He became a research supervisor in that department in 1953 and was transferred to the elastomer chemicals department in 1957.

He is a member of the ACS, the American Physical Society, Sigma Xi, and the New York Academy of Sciences.

Sample Calculations

Specimen weight = 2.98 grams
Specimen volume = 32.3 cubic centimeters
Specific gravity of polymer = 1.25

Burette reading, chamber empty 19.1 ml. (R_1)
Burette reading, specimen in chamber 2.0 ml. (R_2)

$$\Delta V = 17.1 \text{ ml.}$$

Volume of specimen occupied by:

$$(1) \text{ Closed cells} = \frac{17.1 - 2.98/1.25}{32.3} \times 100 = 45.6\%$$

TABLE 1. THE CELL STRUCTURE OF VARIOUS TYPES OF FOAMS

| Foams | Surface | Foam Density Lb./Cu. Ft. | Sp. Gravity of Polymer | % of Volume Occupied by | | |
|--------------------------|----------------|-----------------------------|---------------------------|-------------------------|------------|------------|
| | | | | Closed Cells | Cell Walls | Open Cells |
| Urethane, rigid | no skin | 3.6 | 1.0 | 92.2 | 5.8 | 2.0 |
| Flexible | no skin | 2.8 | 1.0 | 1.3 | 4.5 | 94.0 |
| Vinyl, rigid | no skin | 2.0 | 1.3 | 89.0 | 2.5 | 8.5 |
| Flexible | no skin | 5.8 | 1.25 | 45.6 | 7.4 | 47.0 |
| Flexible | skin one side | 7.3 | 1.25 | 49.4 | 9.3 | 41.3 |
| Polystyrene | no skin | 1.9 | 1.0 | 91.5 | 3.0 | 5.5 |
| Blown Sponge | | | | | | |
| Neoprene, SC-13*, sponge | skin two sides | 37.5 | 1.45 | 0 | 41.0 | 59.2 |
| SC-41*, expanded | no skin | 16.1 | 1.30 | 50.0 | 19.0 | 31.0 |
| Natural rubber R-45* | no skin | 16.2 | 1.31 | 77.0 | 19.0 | 3.3 |

* ASTM designations (D 1056-52T), American Society for Testing Materials, Philadelphia, Pa.

$$(2) \text{ Cell walls} = \frac{2.98/1.25}{32.3} \times 100 = 7.4\%$$

$$(3) \text{ Open cells} = \frac{32.3 - 17.1}{32.3} \times 100 = 47.0\%$$

The results are reliable to $\pm 2\%$ within 90% confidence limits.

Cell Structure of Cellular Materials

The cell structure of various types of elastomeric and plastic foams, as measured by the described apparatus, is shown in Table 1.

It will be noted that foam density is an important factor in interpreting these results. For example, the Neoprene SC-13 sponge has no closed cells; yet only 59% of the total volume consists of open cells. The cell walls actually occupy 41% of the volume of this high-density sponge.

Theoretically it is impossible to obtain 0% open cells in a cut-foam specimen because of the open cells in the surface. The finer the cell structure of the foam, however, the lower will be the volume of open cells exposed. As the surface area per unit volume increases, the percentage of open cells in a substantially closed-cell foam will increase. This effect is shown in Table 2. The cell structure of a single two-inch specimen of closed-cell polystyrene foam is compared with the structure of smaller specimens of equivalent volume. The magnitude of this effect depends upon the cell size.

TABLE 2. THE EFFECT OF SURFACE AREA ON THE STRUCTURE OF FOAMS

| Number and Height of Specimens | | Surface Area, Sq. In. | % of Volume Occupied by | | |
|-----------------------------------|----------|-----------------------------|-------------------------|---------------|---------------|
| | | | Closed Cells | Cell Walls | Open Cells |
| One | 2 inch | 9.1 | 87.5 | 2.9 | 9.6 |
| Two | 1 inch | 11.1 | 83.0 | 2.9 | 14.3 |
| Four | 1/2-inch | 15.1 | 79.5 | 2.9 | 17.7 |
| Eight | 1/4-inch | 23.1 | 68.5 | 2.9 | 29.0 |

Summary

A new apparatus has been described with which it is possible to determine the volume % of open and closed cells in both rigid and flexible foams. The test takes only a few minutes and requires only three simple calculations. The test has been applied to many types of foams including those made with urethane, polystyrene, vinyl, neoprene, and other synthetic and natural rubbers.

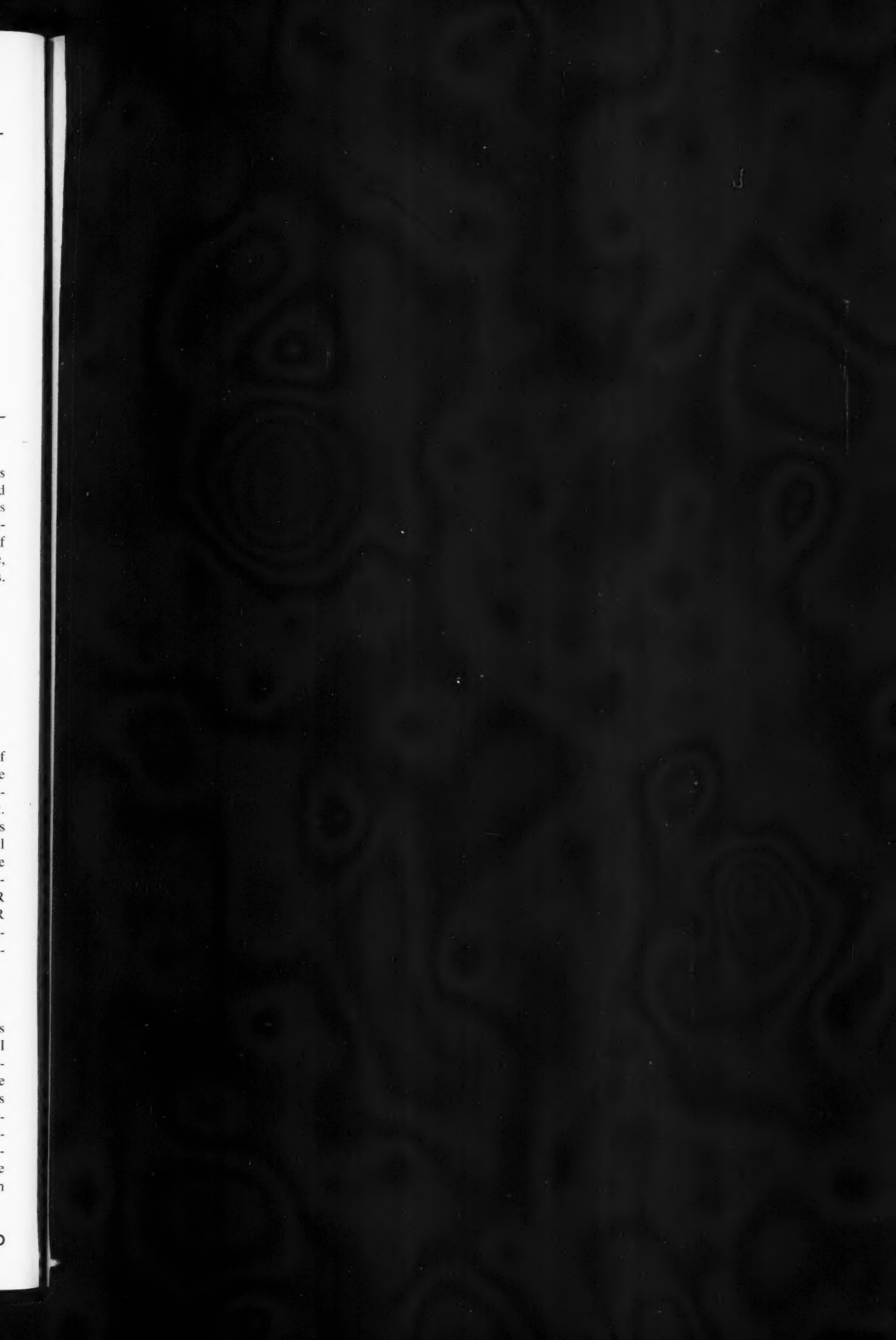
Surface Embrittlement

(Continued from page 260)

In Table 13 the oxygen bomb aged properties of the Cumate and Zimate recipes are shown. Here we see that the Cumate compound has retained elongation very well and shows no surface embrittlement. The elongation, even on the 25-minute cure, which is a severe overcure for the Cumate compound, is still 390%. The aged physical properties of the Zimate compound are very good, also with no surface embrittlement. Please keep in mind that this is an SBR 1001 recipe *without any added antioxidant*. The SBR 1001 polymer contains about 1.5% of octylated diphenylamine added at the time of the polymer manufacture.

Summary and Conclusions

In summary, we find that amine-type antioxidants are superior to the hindered phenol types and the alkyl aryl phosphite types for the prevention of surface embrittlement of mineral-filled SBR vulcanizates. The amine-type antioxidants need not be copper acceptors to be effective. A dosage of 1.5 parts of amine antioxidant per 100 of polymer hydrocarbon added during polymer manufacture is more effective for the prevention of surface embrittlement than when the same antioxidant is added as a compounding ingredient in the same amount to the finished recipe.



The "Science and Technology Act of 1958," S-3126, is now being considered by the Senate's Government Operations Subcommittee on Federal Reorganization. The bill is designed to improve this country's efforts in these important fields and has as its objectives the establishment of Cabinet-level coordination of our science programs, standing Congressional committees on science, National Institutes of Scientific Research, a better program of federal aid to educational institutions, and a better coordinated science information collecting service.

The Commerce Department withdrew its objections in April to the exportation of U. S. technical data on the design of a tire factory being built in Russia by a British combine after Secretary Weeks was assured by U. S. tire manufacturers that the information was already available outside this country. The decision was too late, however, to do an Akron engineering firm, who had been asked almost two years ago to contribute such data, any good in this instance.

A Justice Department complaint against B. F. Goodrich and Dayton Rubber companies for violating the Sherman Anti-trust Act in the manufacture and marketing of sponge rubber was terminated by a consent decree on the same day it was filed. A so-called "English Group" was also involved. Licenses under specified patents to all applicants must now be granted under conditions at least as favorable as those contained in any existing agreements.

A Commercial Chemical Development Association meeting on synthetic rubber revealed some interesting information on the production and consumption in Western as well as in Eastern Europe, the world situation and outlook through 1965, the achievements and problems of the producers of SBR, the influence of synthetic rubber on other industries, and growth prospects for synthetic rubber, its raw materials and compounding ingredients.

Du Pont, producer of both rayon and nylon tire cord, emphasized again the superiority of nylon over rayon at a special press conference in April, aimed at both the tire manufacturer and the public for the purpose of further increasing nylon tire cord use.

MEETINGS

and REPORTS

"The Commercial Impact of Synthetic Rubber," CCDA Theme

The annual meeting of the Commercial Chemical Development Association held at the Hotel Statler, New York, N. Y., March 27, had as its theme "The Commercial Impact of Synthetic Rubber" and attracted an attendance of about 600 persons. The morning program consisted of papers on "European Rubber Developments," by Alan J. Pickett, editor, *Rubber and Plastics Age*, London, England; "Commercial Developments in Natural Rubber," by H. C. Bugbee, president, Natural Rubber Bureau, Washington, D. C.; and "Commercial Developments in Synthetic Rubber," by O. V. Tracy, president, Enjay Co., Inc., New York. Clayton F. Ruebensaal, director of commercial planning, Texas-U.S. Chemical Co., meeting program chairman, presided at this session, and those present were welcomed by Frank E. Dolian, manager of market development, petrochemicals division, Commercial Solvents Corp., president of the CCDA.

At the luncheon session John R. Blandford, counsel for the House Armed Services Committee, discussed "Congress and the Synthetic Rubber Industry." I. E. Lightbown, manager of market development at Enjay and meeting program co-chairman, presided.

During the afternoon, four concurrent panel sessions were held. The first, entitled, "The Commercial Development of Government Purchased Facilities," had as its moderator William P. Gee, president, Texas-U.S. Chemical. The second panel discussed "Influence of Synthetic Rubber on Other Industries," and C. J. Harrington, director of sales, elastomer chemicals department, E. I. du Pont de Nemours & Co., Inc., moderated this panel. "Growth Forecasts for Rubber and the Impact of Other Materials" was the subject discussed by the third panel, which had as its moderator Ross R. Ormsby, president, The Rubber Manufacturers Association, Inc. "Growth Prospects for Rubber Raw Materials and Compounding Agents" was the subject covered by the fourth panel, and William B. Plummer, consultant, was the moderator.

At the Honor Award Dinner in the evening Bernard H. Jacobson, vice

president and director of Food Machinery & Chemical Corp., received the 1958 Honor Award of the CCDA for outstanding achievement in the field of commercial chemical development. This session was presided over by A. J. Dirksen, eastern general sales manager, American Potash & Chemical Corp., chairman of the CCDA program committee, and the presentation was made by Dr. Dolian.

New CCDA Officers

At its annual business meeting on March 26, new officers of the CCDA for the period July, 1958, to July, 1959, were elected as follows: L. E. Johnson, International Nickel Co., president; Walter J. Riley, Westvaco Mineral Products Division, Food Machinery & Chemical Corp., president-elect; Mr. Dirksen, treasurer; and J. G. Affleck, organic chemicals division, American Cyanamid Co., executive secretary.

Newly elected directors are C. H. Bronson, Lever Bros. Co.; and T. C. Dauphine, Hooker Electrochemical Co. Directors serving for a second term are W. M. Barnes, Southwest Research In-

stitute; and W. A. Woodcock, Union Carbide Chemicals Co.

"European Rubber Developments"

Mr. Pickett, in his discussion of "European Rubber Developments—Impact of Synthetic Rubbers and Plastics," first made the point that by 1957 the consumption of synthetic rubber ceased to bear any close relation to the price of natural rubber. Rubber goods manufacturers in both Europe and the United States were turning more and more to synthetic rubber because they knew they could rely on adequate supplies of uniform quality and at a stable price.

When considering the European rubber market, it is no longer a question of natural *versus* synthetic rubber, it was added. When competing in world markets, particularly with the Soviet territories, it may well pay the West European tire manufacturers to stick to synthetic tires with the higher mileages, even if the price of natural rubber should be below that of synthetic rubber.

European rubber consumption for non-tire products is even greater than in the United States and will continue to grow in importance. Whereas in the U.S.A. in 1956, consumption of all kinds of rubber in non-tire products was 37½% of the total, in France non-tire products consumed 40½%, and in Great Britain 45% of the total in that year.

Synthetic rubber capacity in Western Europe for 1958 and 1960, as detailed by Mr. Pickett in Table 1, is expected to amount to 217,200 long tons in 1958, of which 153,000 tons will be styrene-butadiene rubber (SBR) and latex; 10,200 tons of nitrile-butadiene rubber (NBR) and latex; 20,000 tons of neoprene (CR) rubber and latex; 25,000 tons of butyl (IIR) rubber and



McCutcheon Studio

I. E. Lightbown



Pach Bros., N. Y.

Clayton F. Ruebensaal

TABLE 1. WEST EUROPEAN SYNTHETIC RUBBER CAPACITY

| (1,000 Long Tons) | | | | | | |
|-------------------|-----|----------|------|----|---------------|------|
| Country | SBR | IIR, PIB | NBR | CR | Hy Sty Resins | Date |
| France | — | 20 | — | — | — | 1958 |
| | 40 | — | — | — | — | 1960 |
| | — | — | 3 | — | 3 | — |
| West Germany | 56 | 5 | 1.2 | 20 | — | 1958 |
| Holland | — | — | yes | — | yes | 1959 |
| | 55 | — | — | — | — | 1960 |
| Italy | 35 | — | — | — | — | 1958 |
| | 60 | — | — | — | — | 1959 |
| Spain | 8 | — | — | — | — | — |
| United Kingdom | 62 | — | 9 | — | 9 | 1958 |
| | — | — | — | 20 | — | 1960 |
| Western Europe | 153 | 25 | 10.2 | 20 | 9 | 1958 |
| | 281 | 25 | 13.2 | 40 | 12 | 1960 |

polyisobutylene (PIB); and 9,000 tons of high styrene-butadiene resins and latices. The total Western European capacity is expected to rise to 371,200 tons by 1960, most of the increase being in SBR.

The position in the Communist countries was said to be more obscure, but an output of 462,000 tons is expected for 1958 and 650,000 tons by 1960. Out of a total of 20 plants in Eastern Europe there are known to be four plants producing neoprene, and there is a considerable output of nitrile rubber. The Russians are also producing synthetic polyisoprene, which has been tested extensively in tires, it was added.

TABLE 2. EAST EUROPEAN SYNTHETIC RUBBER CAPACITY
(1,000 Long Tons)

| Country | Amount | Date |
|------------|--------|------|
| E. Germany | *76 | 1958 |
| | *100 | 1960 |
| Poland | 36 | 1958 |
| | 50 | 1960 |
| Rumania | 50 | — |
| Russia | 350 | 1958 |
| | 450 | 1960 |
| E. Europe | 462 | 1958 |
| | 650 | 1960 |

*Includes 22,000 long tons NBR.

Mr. Pickett next pointed out that in Europe in many instances natural rubber is being replaced by a synthetic rubber, or a plastic, or a combination of the two. At present about 8,000 tons of polyvinyl chloride are used per year in British conveyor belting, replacing about 7,000 tons of rubber. In hose, natural rubber is being replaced with oil-resistant synthetic rubbers and PVC, and in coated fabrics and footwear both synthetic rubber and PVC are replacing natural rubber. It was also pointed out that synthetic rubber, PVC, and polyethylene have almost entirely replaced natural rubber in wire and cable insulation, and that in the European foam rubber market flame-resistant neoprene, PVC, and urethanes have made considerable inroads.

High styrene-butadiene copolymers

for shoe soling and rigid rubber-modified resins, as developed in the U.S.A., are of interest in Europe, and their use is expected to grow steadily.

Consumption of synthetic rubber in Europe will, by 1960, be somewhere between 42 and 71% of the total natural and synthetic rubber consumed. West European synthetic production is expected to be 371,000 tons in 1960, and to achieve the 71% figure about 250,00 tons would have to be imported per year from North America. This may be Western Europe's only protection against Russian competition. In 1956, Russian and American synthetic rubber consumption accounted for more than 60% of the total in each country, and this will probably rise to more than 70% by 1965, Mr. Pickett declared.

In conclusion, it was said that in Europe synthetic rubbers and plastics will continue to gain from natural rubber and that together they constitute what is probably the biggest growth industry of all times. Once the Free Trade Area is established, the supply of synthetic rubber to Europe may resolve itself into direct competition be-

tween the economic potential of East and West. There will be great scope for SBR, NBR, butyl, and neoprene rubbers, in addition to the newer polymers such as *cis*-1,4 polyisoprene, *cis*-polybutadiene, ethylene-propylene copolymers, and the polyurethanes.

"Commercial Developments in Natural Rubber"

Commercial developments in natural rubber, Mr. Bugbee pointed out are of fairly recent origin. They are for the most part concerned with the plantation or production end of the business. The effort is directed largely toward increased tree yields, lower production costs, and improved initial preparation of the commodity itself.

The producing industry, as such, supports six major research units, one each in Malaya, Viet Nam, Indonesia, England, France, and Holland. Some results from these research groups are the production of Superior Processing Rubber, development of Heveaplus MG 50 (an interpolymer of natural rubber and polymethyl methacrylate), compounding natural rubber for high- and low-temperature service, and the development of high-yielding clones.

In this connection it may be noted that although the average yield per acre per year for all estates in Malaya is only 500 pounds; selected clones from the Malayan Rubber Research Institute have provided mean annual yields of 1,500 to 2,000 pounds per acre over a 10-year period. More recent plantings with improved clones indicate that a 2,500-pound yield is obtainable.

In the United States, the Natural Rubber Bureau Laboratory (supported by the rubber growers of Malaya) is conducting work on the use of dry rubber and rubber latex in asphalt for road construction.

In discussing the economic side of the picture, Mr. Bugbee said that natural



A. J. Pickett



Tommy Weber

Frank E. Dolian

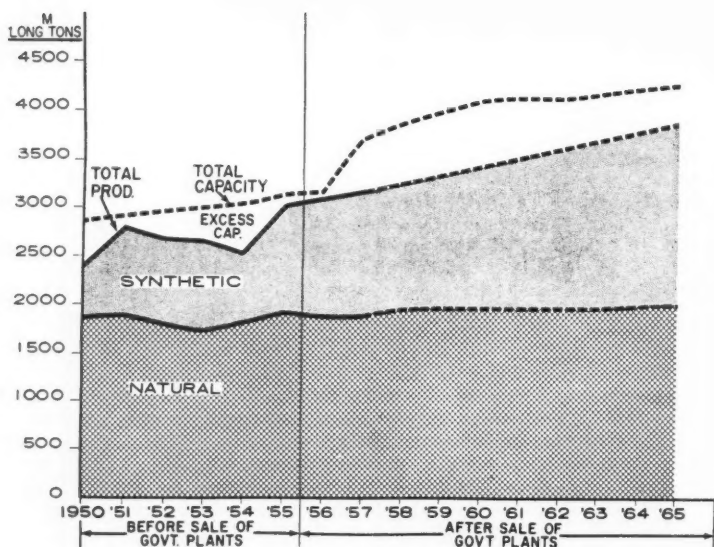


Fig. 1. World rubber situation and outlook (a more conservative view)

rubber had been standing on its own feet for the past 50 years, and that he expected it to continue to do so for the next 50 years. Natural rubber production during the next five years will range between 1,900,000 and 1,960,000 long tons. Furthermore it is estimated that if the present rate of planting is maintained in Malaya, the current production rate will be doubled by 1980.

"Commercial Developments in Synthetic Rubber"

Mr. Tracy's paper, "Commercial Developments in Synthetic Rubber," was essentially a historical economic review of the synthetic rubber industry since it was first acquired from the United States Government in the latter part of April, 1955.

Records show that the installed capacity for synthetic rubbers of all types in May, 1955, was 1,088,000 long tons. As of December 31, 1957, installed and building capacity was 1,532,000 long tons. Thus, under private ownership, the synthetic rubber industry in the United States has grown in the order of 444,000 long tons, or just about 41%.

This remarkable growth record has resulted in many rubber manufacturers approaching self-sufficiency in their primary raw material, and today, in fact, combined national styrene-butadiene rubber (SBR) capacity is temporarily ahead of market requirements.

In 1965, according to Mr. Tracy, the world synthetic capacity (including oil-extended rubber) will be 2,270,000 long tons. With an expected 2,000,000-long-ton production of natural rubber, world capacity will be 4,270,000 long tons. This is precisely the RMA's estimate of world rubber requirements! Mr. Tracy suggests, however, that this is an

optimistic estimate and that there will still be some "excess capacity" as late as 1965. (See Figure 1.)

The synthetic rubber industry because of its growth and size has had considerable influence on the economy as a whole through the stimulation or advancement of other industries; chief among these are the suppliers of rubber raw materials. Here the chemical and petroleum industries figure largely as producers of butadiene, styrene, acrylonitrile, isoprene, and carbon black. Some of these chemicals, such as styrene and acrylonitrile, have found non-rubber uses; but the majority continues to be tied to the synthetic rubber industry, and "as synthetic rubber goes, so go they." In this connection it must be noted that butadiene is in over supply at the moment.

Other raw materials less closely

connected with the growth of synthetic rubber, but swimming in the same stream are accelerators, antioxidants, antiozonants, plasticizers, oils, and pigments.

Aside from raw materials, other industries have been influenced by synthetic rubber research and development: namely, the paint, paper, and adhesive industries.

In design engineering, the unique properties of many synthetics (ozone resistance, fluid resistance, high tear strength, abrasion resistance) have resulted in many new and improved mechanical goods products.

The effect of synthetic rubber research on the industrial scene is by no means a static one. Recent contributions from rubber research laboratories, whose industrial potential is still undetermined, are such materials as *cis*-polyisoprene, *cis*-polybutadienes, polyurethanes, and isocyanate foams.

All told, the making, selling, and applying of synthetic rubbers and their raw materials have developed into an impressive industry.

Congress and Synthetic Rubber

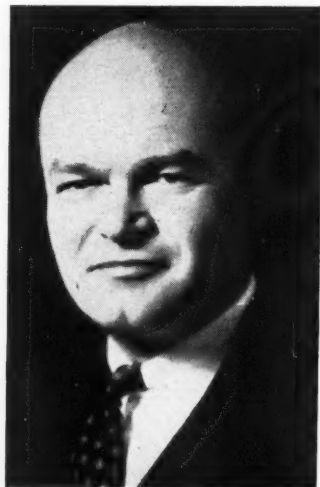
Mr. Blandford began his talk by saying that the story of the synthetic rubber industry could only have happened in America. He reviewed the industry from 1947 when he was assigned as counsel to a subcommittee of the House Armed Services Committee under the chairmanship of the late Paul Shafer, Michigan Congressman who contributed so much to the rubber legislation from that time until his death.

The first legislation on rubber in which Mr. Blandford was involved was Public Law No. 24, which eliminated the government as exclusive purchaser of natural rubber, but prohibited the sale of any synthetic rubber facility which cost more than \$5 million except for the neoprene plant, the styrene



Del Ankers Photographers

H. C. Bugbee



O. V. Tracy

plants, and two alcohol-butadiene plants.

In the 1947-1949 period the problem was to keep the synthetic rubber industry alive and operating in competition with forecasts of increased production of natural rubber, and the Synthetic Rubber Act of 1948 kept the government in the business. The matter came up again in 1950, and the extension of the Rubber Act until 1952 which kept the plants in government hands was fortunate since the Korean war began at about that time, and demand for synthetic rubber rose with the higher prices for natural rubber.

By 1953 the House Armed Services Committee was convinced that synthetic rubber had finally arrived at a place in the industrial world where it could compete openly with natural rubber. As a result, the Disposal Act of 1953 was finally passed, and a Rubber Facilities Disposal Commission appointed. Mr. Blandford paid tribute not only to the late Mr. Shafer for his part in framing the Disposal Act of 1953, but also to the Disposal Commission members for their excellent work in administering the successful disposal program.

The story of the synthetic rubber industry in this nation is an outstanding tribute to the system of government under which we operate, Mr. Blandford said in conclusion. Where else, but in America, could an industry that was discovered by free enterprise, constructed with federal funds, operated under a voluntary patent pooling arrangement by a federal agency, sold by a government commission, end up by being returned to the free enterprise system, he asked.

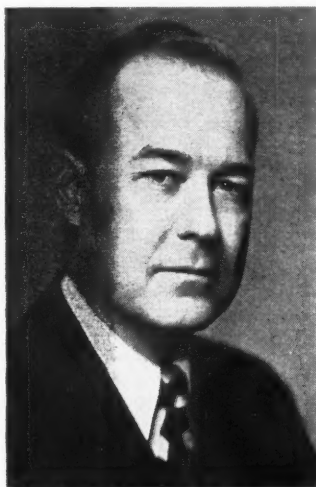
Commercial Development of Government Facilities

The panel on "The Commercial Development of Purchased Government Facilities," had as its moderator William P. Gee, president of Texas-U. S. Chemical Co. Members of this panel consisted of Gordon A. Cain, vice president, Petro-Tex Chemical Corp.; Paul W. Cornell, vice president, Goodrich-Gulf Chemicals, Inc.; John P. Cunningham, manager, synthetic rubber sales division, Shell Chemical Corp.; and Ancel B. Leonard, director, rubber chemical division, Phillips Chemical Co.

In his introductory remarks Mr. Gee first mentioned that it was just three years ago that the \$325-million worth of synthetic rubber facilities were disposed of to private industry, facilities which had been designed, constructed, and operated over a period of 12 years by private industry with government financing. Since the takeover date the butadiene capacity has been approximately doubled at a cost of about \$150 million, and the copolymer facilities have been enlarged 41%, with an expenditure of about \$60 million. In addition, the industry saw the introduction

of three completely new plants and three new firms in the field.

For a period after takeover the synthetic plants ran on a very profitable basis during a period of very high rubber consumption, no sizable new capital expenditures had yet been made, and time had not allowed for a build-up of "normal" research and selling expenses.



Fabian Bachrach

W. P. Gee

Contrasted with this early period, the industry now finds itself in a period of marked decrease in consumption and resultant cutbacks in production, with competition intensified. This situation would indicate the need of an economic reappraisal of the industry under conditions of operating at rates below full plant capacity, with higher commercial expenses and increasing unit production costs, Mr. Gee said. He went on to point out that in exchange for a fair selling price for synthetic rubbers, the producing industry can, through research, offer new diverse markets and stable prices, which will, in turn, help to stabilize the previously widely fluctuating natural rubber market and also promise natural security and eventually effect reduction of the huge government-owned natural rubber stockpile.

To compete in the tight market for capital investment and development funds, however, the synthetic rubber industry must match or better the economics realized by the growth products of the chemical, petroleum, and plastics industries, to which it is related.

The manufacture of synthetic rubber has been one of our faster growing industries, and a continuing expansion at a rate of about 4% a year through the early 1960's was predicted. To continue at this growth rate, new light-colored synthetic rubbers to win back markets lost to plastics and to open up whole new fields of colorful products with better physical properties, lower cost materials with higher oil extension, faster curing and easier processing

rubbers are all development goals which must be and are being met, Mr. Gee declared.

Panelist Cornell first pointed out that whereas synthetic rubber research under government operation involved an expenditure of about \$6 million a year, producers now are spending at a rate of at least \$12 million a year, which amounts to about 2½% of sales, and will increase their research expenditures if the profit situation permits.

Technical service to customers is more active now than under government operation, and although producers are more concerned with improving existing rubber than developing new types, this latter phase of development and technical service is not being neglected. Emphasis is now on better product color and improved carbon black, oil, and oil-black masterbatches, and it was predicted that superior masterbatches of all these types would become available soon.

Packaging methods have changed rapidly, and there is still much room for improvement in this field in order to provide for better handling and warehousing. Crumb rubber, as marketed by Goodrich-Gulf, is a relatively new development, but is probably not the complete answer to this problem.

There is a continuing need of research in connection with the competition of urethanes with synthetic rubber latices, natural and other rubbers for highway use, and to provide a styrene-butadiene rubber (SBR) with better hysteresis properties in order to be more competitive with natural rubber, Mr. Cornell declared.

Mr. Leonard stated that technical service as an aid in selling and developing markets for materials going into finished rubber goods is an important part of any comprehensive marketing program today, and its importance is increasing. He added that a comprehensive technical service program in the synthetic rubber producing industry should include the following functions:

- (1) Aid to the customer in developing the best and cheapest method of processing and curing for given applications and involving not only the selection of the best polymer, but also the best compounding ingredients. Occasionally this service may extend to assistance in the mechanical design of the product or to the design of special production equipment.

- (2) Search for new applications for existing rubbers.

- (3) Development by the research department of new polymers or modifications of existing polymers to meet the needs of applications for which existing polymers are not adequate, with the technical service department having a secondary responsibility in this case.

- (4) Investigation of customer inquiries and problems of a technical nature.

- (5) Cross-checking of tests with plant control laboratories or with customers'

laboratories to help maintain uniform procedures and reliability of testing.

It was suggested that the plastics raw material producing industry spends more time working with their customers' customers than the synthetic rubber producing industry and that the SBR producers might profitably increase their efforts along these lines. Referring to the synthetic rubber industry as a whole, however, this panelist doubted that any substantial increase in expenditures for technical service in this country would result in a justifying increase in market, but the export market was a different matter, he added. Exports of synthetic rubber should amount to 208,000 long tons by 1960 and 460,000 long tons by 1965 and thus represent an expanding export market for synthetic rubber.

Although American production costs may be lower than foreign synthetic rubber producers for some time, import duties may give local rubber a delivered price advantage which will have to be offset by better quality and technical service from American producers.

Mr. Leonard felt that one of the most serious problems facing SBR producers at present is inadequate selling price, which is the same as it was three years ago, while the cost of new capital equipment, freight, labor, and most raw materials and supplies has advanced substantially. Today's prices do not permit a satisfactory return on investment, do not adequately provide for replacement of worn out and obsolete equipment, and do not provide the funds needed for research and development to keep the industry growing and healthy. Continuation of such a situation can result only in stifling of progress to the disadvantage of the rubber goods manufacturer and the rubber consuming public, he concluded.

Mr. Cunningham's remarks were directed to the differences between government and private operation of the synthetic rubber industry from the marketing standpoint and particularly from the viewpoint of the rubber products manufacturers who did not participate in the purchase of the plant facilities.

He emphasized that no small rubber products manufacturer suffered from lack of synthetic rubber during the period of rubber shortage which occurred soon after private industry took over the synthetic plants during the boom year of 1955. Independent operators were in fact able to buy synthetic rubber while producer-consumers went into the higher priced natural rubber market for an increased portion of their total requirements in order to make this possible.

Mr. Cunningham commented briefly on the growth of synthetic rubber research, development, and technical service under competitive marketing conditions. Advertising, which was not employed under government management, has proved a valuable medium

for the dissemination of technical information together with technical bulletins, catalogs, and other promotional material.

Under government operation, synthetic rubber distribution to consumers was handled by a central agency, an efficient arrangement, but one which required ordering in advance. Today competition has assured every consumer prompt shipment of the rubber he desires, in the package he prefers, made by the manufacturer he favors, from a convenient stock point, thus reducing his advance commitments and the size of his raw material inventories.

Three years' operation of the SBR plants under free competition has resulted in a steadily increasing multiplicity of grades to meet customers' special requirements. The trend is toward transferring initial compounding operations from the consumer's plant to that of his rubber supplier.

In answer to a question from the floor, Mr. Cunningham said that the stability of the price of SBR since plant takeover was because competition had kept the price from going up while costs had kept it from going down, and that the purchaser of SBR was today getting one of the best buys in American industry.

Mr. Cain, in discussing butadiene, referred to the 621,000-short-tons-a-year capacity in the Spring of 1955 when the government plants were sold, the increase in this capacity by the end of 1955 to 675,000 tons, by the end of 1956 to 748,000 tons, and by the end of 1957 to 1,065,000 tons. By the end of 1958, butadiene capacity will have risen to more than 1,200,000 tons. Consumption in 1957 and 1958, at about 800,000 tons each year, is now considerably less than capacity, and the price has changed from an f.o.b. plant basis to a delivered basis, with a consequent increase in producers' transportation costs.



Willard Stewart, Inc.

Charles J. Harrington

In early 1955, 11% of the capacity was by-product butadiene; 15% was based on butane as a raw material, and the remaining 74% used refinery butylene as feed stock. The six Houdry butane dehydrogenation units installed by four companies in 1957 increased the capacity based on butane to more than 400,000 tons a year or 40% of the total capacity by the end of 1957. The increased demand of refinery butylene for high-octane gasoline has made this partial conversion to butane desirable.

In 1958, butadiene plants will be built in Canada, Italy, Germany, and England, and there are rumors of plants under consideration in several other countries, Mr. Cain said. Some of the new SBR plants have been completed abroad ahead of the associated butadiene plants, and there has been some export of butadiene, but it is unlikely that this export will be on a continuing basis.

The amount of money spent on butadiene research is increasing, and much of it is spent for catalyst research since an increase in the yield of butadiene from butylene of only one percentage point in a large plant, for example, will save about \$250,000 a year in feedstock cost.

The independent butadiene producers are concerned about having only one customer—the rubber industry. Butadiene's chemical versatility, low stable price, and abundant supply will in time, however, lead to substantial new uses for butadiene, in Mr. Cain's opinion.

The most realistic attitude an independent butadiene producer can take is that for better or worse he is tied to the synthetic rubber industry. Part of his research budget should be spent on the premise that whatever monomers the synthetic rubber industry uses, he will make them, this panelist concluded.

Influence of Synthetic Rubber on Other Industries

"Influence of Synthetic Rubber on Other Industries" was the topic of discussion of a panel moderated by C. J. Harrington, E. I. du Pont de Nemours & Co., Inc. Panel members included Lt. Col. H. C. Hamlin, Wright Air Development Center; G. H. Swart, The General Tire & Rubber Co.; J. R. Forrester, Jr., Ford Motor Co.; S. C. Nicol, Goodyear Tire & Rubber Co.; and R. A. Schatzel, Rome Cable Corp.

Mr. Harrington defined the scope of the discussion to be "the effect on end-use industries of synthetic rubber as an industry." In his opening remarks he reviewed the development of the synthetic rubber industry since World War II, at which time he said the polymers made could be controlled as to average molecular weight and the end groups on them, but the exact chain structure was largely happenstance. We are now entering an era when the chain structure will be more

exactly controlled, and where we can polymerize in place, he added.

Although the insulated wire and cable industry is a segment of the electrical industry, it uses 3% to 4% of all rubber consumed in the United States, Mr. Schatzel said. Prior to World War II, this 3% to 4% was natural rubber; today the rubber now used is approximately 95% synthetic.

According to Mr. Schatzel, synthetic rubber has enabled insulated cable to operate at higher voltages and temperatures (to 150° C.), to have greatly increased moisture resistance, and has made possible increased wire and cable production. In this connection, Mr. Schatzel stated that lead coating and cotton braiding are now virtually extinct cable fabrication processes.

In many cases, Mr. Schatzel noted, if synthetic elastomers were not available, present commercial and federal wire and cable specifications would have to be completely rewritten, e.g., Federal Mine Safety Regulations (Schedule 2 F) and Navy Shipboard Cable Specifications.

Future developments that the wire and cable industry expect from the synthetic rubber industry are elastomers for use at still higher temperatures (to 600° C.), greater moisture resistance, and increased high-voltage breakdown resistance.

Mr. Nicol opened his talk by paying tribute to the two scientific groups that got the synthetic rubber industry started and kept it going: namely, polymer chemists and rubber compounds.

He then stated that about two-thirds of the rubber hydrocarbon used by the tire industry today was synthetic rubber. All passenger tires on the market today (U.S.A.) have an all-synthetic tread, and in many cases a large portion of the tire carcass is also of synthetic rubber. Beneficial effects of synthetic rubber have been increased tread wear (15-25%) over natural rubber, improved resistance to tread cracking, and better weathering.

In the case of large bus and truck tires the story is different. These tires must at present use considerable natural rubber in their make-up; but when the isotactic polyisoprene polymers become commercially available, they may entirely supplant natural rubber, and even truck and bus tires may be "all synthetic."

In conclusion Mr. Nicol stated that the rubber industry's big usage of synthetic rubber was in tires, tubes, and mechanical goods. The general effect of synthetic rubber on the rubber industry has, Mr. Nicol said, been a "good and healthy one."

Mr. Forrester, representing the automotive industry, gave a dramatic story of how essential synthetic rubber is to the day-by-day operation of a typical one-year-old (1957-model) car. His enumeration of critical rubber parts that would fail within one year's use if they were made of natural rubber



Blackstone Studios

Ross R. Ormsby

instead of today's more durable synthetic rubber was amazing.

Although we are prone to think that rubber's only connection with the automobile is its set of tires, we couldn't be more wrong. This picture is highly distorted! Fuel-pump lines, fuel-pump diaphragms, valve-stem seals, radiator hose, various assorted gaskets, fluid-transmission seals, and many more essential parts of today's car must be of synthetic rubber if the car is to have more than a few months' service life.

Colonel Hamlin's story might have been titled, "A Tale of Two Chemicals"—use of synthetic rubbers in aircraft parallels the development of improved aircraft lubricants.

The early aircraft lubricant was, according to the Colonel, castor oil and natural rubber oil seals gave satisfactory performance. When petroleum oils were introduced (1930-World War II), neoprene appeared and was a satisfactory elastomer for fuel lines and sealing applications. During World War II and through Korea, jet fuels and high-temperature hydraulic fuels demanded a different-type seal, and the nitrile-type rubbers appeared on the scene. Today high-temperature requirements have reached the point that fluorinated hydrocarbons such as Kel-F¹ and Viton² (also some special silicones) must be used in many aircraft applications.

Although the present fluid resistant, high-temperature elastomers are very superior materials compared to natural rubber, they are still not quite good enough for the aircraft of the future.

Whenever possible, this speaker added, the aircraft engineer "designs around an elastomer application"; that

¹Minnesota Mining & Mfg. Co., Jersey City Chemical Division, Jersey City, N. J.

²Trade mark of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

³Trade Mark, Thiokol Chemical Corp., Trenton, N. J.

is, he seeks ways and means of eliminating as many elastomer uses as possible. Unfortunately this is easier talked about than done. For example, a recent engine's first design called for 178 elastomer applications—two years and many drawings later, the design engineer and his staff had succeeded in eliminating only 30 of the original design's 178 applications.

"Nothing can do rubber's job," Hamlin stated, "as well as rubber."

For the future, the Air Force wants elastomers capable of withstanding still higher temperatures (continuous duty at 500-600° F.) and more severe fluid erosion.

Mr. Swart called attention to the growing use of synthetic latices in industry.

The paper industry, for example, depends upon general-purpose SBR latices for clay-binders, and acrylonitrile-butadiene latices to give high strength and grease resistance.

Water emulsion paints, based on SBR latices, have virtually revolutionized this age-old industry, he said.

Non-woven fabrics, the glamour-item of today's textile industry, would not be possible without a latex-based binder. These materials find an ever-increasing use as outer wear fabrics and as backing for upholstery and carpeting.

Foam production for many years was almost exclusively the domain of natural rubber. The present use-pattern is entirely different: the polyurethane foams, Mr. Swart noted, are replacing much natural rubber foam in this area.

Growth Prospects, Rubber and Other Materials

The panel on "Growth Forecasts for Rubber and the Impact of Other Materials" included Ross R. Ormsby, The Rubber Manufacturers Association, Inc., as moderator; and J. R. Strickland, Stanford Research Institute; J. D. Mahoney, Mobay Chemical Co.; S. M. Martin, Jr., Thiokol Chemical Corp., and K. O. Nygaard, The B. F. Goodrich Co., as panelists.

In his opening talk, Mr. Ormsby stressed the fact that when the rubber industry now talks about 63% synthetic in domestic consumption and possibly 65 to 70% in the 1960's, we are really talking about the distribution breakdown in the "conventional" rubber types (SBR, IIR, NBR and CR). In the not too distant future we will need to concern ourselves with the production-consumption pattern of other now less known elastomers as polybutadienes, Hypalon², the silicone types, Thiokol³ polysulfide rubber, the fluoride rubbers as well as the rubber-like plastics such as the vinyls and polyurethanes.

Mr. Ormsby noted that while there has been some competition between synthetic rubber and natural rubber, the general effect of the production and development of synthetic rubber has

been to broaden and extend the horizon of the rubber manufacturing industry. We are now entering an era of competition between the various synthetics, and here again, Mr. Ormsby stated, we can expect a further broadening of scope of the manufacturing side of the rubber industry.

The future growth of the rubber industry is not preordained, J. R. Strickland said, but is largely up to the ingenuity of the industry itself.

Further growth can come about, Strickland declared, through the introduction of new products, displacement with rubber of existing materials in manufacturing, and by supplying other fast-growing industries.

On the statistical side of the picture, Strickland observed that the chemical industry—of which rubber is a part—has a long-term growth rate of 11% per year. Among other "synthetic groups" of chemical industry, synthetic rubber ranks fourth as follows: (1) fibers; (2) plastics (growth rate, 16%); (3) medicinals (growth rate, 20%); (4) synthetic rubber (growth rate, 4-5%). This low growth rate, compared to the long-term average for all chemical industry, is probably due to the fact that synthetic rubber has already captured most of what was formerly natural rubber's domain, and appreciably less opportunity for market expansion now remains.

Mr. Strickland concluded his talk by presenting an "economic balance sheet" for the synthetic rubber industry as shown below:

ASSETS OF SYNTHETIC RUBBER INDUSTRY

1. Synthetic rubber lends itself to development for vast areas of new products.
2. Good company management.
3. Close link between producers and fabricators.
4. Synthetic rubber can replace materials other than elastomers.
5. Synthetic rubber, as such, now has consumer acceptance.

LIABILITIES OF SYNTHETIC RUBBER INDUSTRY

1. More than slightly dependent on the automotive industry and other vehicle transportation.
2. Probably cannot replace more natural rubber because of the high percentage of the market it now controls.

K. O. Nygaard opened his talk with a review of the current world rubber supply-demand situation, then proceeded to "take the bull by the horns" and presented some very interesting predictions of future synthetic rubber growth trends.

The free-world demand for synthetic rubber of all types is expected to double in the 10 years ahead from 1.3 million long tons to about 2.4 million long tons by 1967. At this time the U.S.A. will probably be using roughly 75%

synthetic rubber, as compared to the present 63%.

Furthermore, in the 10 years ahead, U. S. consumption of new rubber is expected to grow by about 3% per year compounded based on the estimated trend in motor vehicles in operation, the growth in auto production, and trends in other industries using rubber products. Last year 51 million passenger cars were in use, and Nygaard estimates that by 1967 close to 70 million passenger cars will be on the nation's highways.

Corresponding to this increase in passenger-car use, the truck-bus fleet is expected to increase from a present 10½ million trucks and buses in operation to a 1967 figure of 13½ million. In short, according to Nygaard, total rubber industry shipments of pneumatic tires will rise from about 109 million tires to more than 140 million units in 1967. During the same period we can expect the 1967 demand for industrial rubber products to increase slightly more than one-third of the present 1957 demand, Nygaard said.

What will be the story for 1958? Estimated consumption for this year is about 1.4 million long tons, down 3-4% from 1957 use. Passenger-car production for 1958 is estimated at 4.5-5 million units, as compared to 1957's 6.1 million units. Truck production for 1958 will be between 850,000 and 950,000 units.

A breakdown of the end-use of rubber was given by this speaker as follows: passenger-car tires—32%; truck tires—20%; other-type tires—4%; repair materials—7%; industrial products—13%; latex—5%; footwear—5%; cable and insulated wire—3%; other rubber products—11%.

As regards the growth of the various synthetic rubbers, past data indicate that both neoprene and nitrile-types have shown rapid increases. Looking ahead, it is certain that there will be increased competition among the four major synthetic rubbers (SBR, NBR, IIR, and CR). It is entirely possible that butyl (IIR) and nitrile-types (NBR) may increase at the expense of neoprene (CR), and possibly IIR, CR, and NBR rubbers may increase at the expense of SBR.

Polyurethane foams, the greatest thing since night baseball, was the general theme of J. D. Mahoney's talk.

Aside from a thorough discussion of the physical and chemical properties of polyurethane foam (which was not the stated objective of this panel), Mr. Mahoney contributed the following breakdown of the end-use of these new and interesting materials. Of the total 1957 market for foam, seven million pounds went into sponges, mats, etc.; three million pounds were used in crash pads; two million pounds, in furniture production; two million pounds of rigid foam were produced; and one million pounds each went into mattress pads, packaging, and underlays.

The market estimate for 1958 is 47 million pounds allocated as follows: furniture and bedding—20 million; automotive applications—9.5 million; pads, mats, sponges, wall tile, and gaskets—eight million; insulation and rigid foam—four million; underlays—three million; packaging—2.5 million.

Dr. Martin pointed out that although the transportation segment of the rubber industry used 63% of all new rubber (1957), it accounted for only 47% of all sales.

Total sales of non-transportation rubber is now greater than sales of transportation rubber. Thus it is in this area that the specialty rubbers find their greatest growth potential.

Among the specialty elastomers which have unique chemical and physical properties, and thus lend themselves to wide usage in engineering developments, are Thiokol polysulfide rubbers, neoprene, nitrile and butyl rubbers.

Thiokol, neoprene, and nitrile type rubbers are noted for their excellent fluid resistance and have found extensive use in rubber hose manufacture.

More recently, certain modifications of Thiokol polysulfide rubbers resulted in a liquid polymer which is being used as a binder in rocket motor fuels. Undoubtedly more developments can be expected in this area.

Butyl rubber, because of its ability to retain air, was used originally to make tire inner tubes. Since the introduction of the tubeless tire, this usage has almost disappeared. However, because of its many attractive properties, butyl may again return as a transportation rubber, this time as a completely all-butyl tire.

Butyl tires meeting U. S. Ordnance performance specifications have been manufactured, Dr. Martin reported. It is claimed that these tires are of considerable importance in maintaining vehicles in efficient "standby" operating conditions (butyl has excellent ozone and weathering resistance). Furthermore it is reported, Dr. Martin said, that butyl tires run quieter than SBR tires; butyl tires do not squeal, and they offer greater safety by enabling the car to stop up to 30% faster on wet or dry pavements. There is little doubt, according to Dr. Martin, that butyl tires will soon be on the market. The unknown factor is the depth to which the butyl tire will penetrate the transportation market.

Raw Materials and Compounding Agents

"Growth Prospects for Rubber Raw Materials and Compounding Agents" was moderated by William B. Plummer, consultant. Members of this panel were Howard H. Heilman, consultant; Carl W. Sweitzer, director of research and development, Columbian Carbon Co.; William F. Tuley, group manager, chemical development, Naugatuck Chemical Division, United States Rub-

her Co.; and Herbert A. Winkelmann, vice president and technical director, Dryden Rubber Division, Sheller Mfg. Corp.

Mr. Plummer, in introducing the panel members and starting the discussion, asserted that the history of the development of the rubber industry has been directly related to the development of chemical compounding agents, without which the wide variety of present-day rubber compounds and rubber products would not be possible. According to one source, he added, in 1930 there were 13 classes of compounding ingredients which included some 200-plus items. With the growth of the synthetic rubber industry and other technical improvements, these figures have, in 1958 become 13 classes with 1,274 items, with 13 additional new classes such as tackifiers, processing aids, anti-scorch agents, etc., with 233 items, bringing the total to 1,507 items.

Dr. Heilman referred to "the investment impact of the synthetic rubber industry," indicating that low prices of raw materials for synthetic elastomers were adverse factors of investment in the petrochemical industries. He said that economics is a matter of judgment of business competition and profit and not merely of providing statistical data.

Dr. Heilman reported that the cost of butadiene is low, and the material is readily available. Its price might rise $\frac{1}{2}\epsilon$ in one year to three years, but for the interim 15ϵ a pound can be considered a stable price. The later increase will reflect the fact that labor, fuel, and operating costs are increasing, and in the longer term important price increases in petroleum itself may develop. Nevertheless, butadiene will remain the king monomer for the synthetic rubber field, he said.

Currently, he reported, there is much interest in isoprene, and its price is expected to drop to 18-19¢ a pound, as compared with butadiene at 15¢ a pound. Isopentane, the raw material for isoprene, is the key cost factor, and its cost is approximately three times the cost of butane, the butadiene raw material. An additional cost factor is that *cis*-isoprene must be supplied at a higher degree of purity than either butadiene or styrene.

The demand for acrylonitrile monomers has grown exceedingly rapidly, and capacity currently exceeds demand for this monomer used in synthetic rubbers and fibers. Styrene, readily available, is low in cost at 12.5¢ a pound and is used by both the rubber and plastics industries. An appreciable capacity increase for this monomer is expected about 1960-61, but the price will then rise to about 13-14¢ a pound, owing to an increase in overall costs from these new plants.

The past and future foreseeable trends indicate that the petrochemical phase of the chemical industry has attained maturity with consequent



Moffett Chicago

William B. Plummer

severe competition and lower profit margins, Dr. Heilman concluded.

Dr. Sweitzer discussed reinforcing pigments, considering both carbon blacks and non-black materials. Carbon blacks are of primary importance because of their superior reinforcing and strengthening effects when compounded into rubber and because of their low cost, $5\frac{1}{4}$ to $8\frac{3}{4}\epsilon$ a pound, their low gravity, and the variety of grades offered for special applications. Of the 1.8 billion pounds of carbon black shipped in 1957, about 95% went to the rubber industry, of which in turn about 50% went into the tire branch of the industry.

The raw material for carbon black is hydrocarbon, and whether natural gas and petroleum oils have been used to date is almost entirely a matter of economics. In the absence of these two basic materials the carbon black industry could function with such raw materials as turpentine and vegetable oils.

The carbon black industry developed pelletized carbon black to permit bulk shipments and to aid in plant cleanliness and has also played a large role in developing methods for incorporating carbon black in the latex stage at the polymer plants; this process is known as wet masterbatching.

In mentioning non-black pigments such as silica, calcium silicate, clays, zinc and iron oxides, whiting and lignin, he described the three general methods of their production, that is, fuming from a vapor phase, chemical precipitation, and mechanical grinding. Fineness, in general, increases in going from grinding to precipitation to fuming.

The fumed silicas are the most interesting since they approach the finer carbon blacks in reinforcing properties and in silicone rubbers are superior to carbon blacks. The clays are large-tonnage pigments, totaling

more than 500 million pounds a year, and consumption is also high for zinc oxide and the calcium carbonates. Silica pigment tonnage was estimated at 10 million pounds a year. Lignin reinforcing agents have been under investigation for some years, but the prospects seem less promising than for the fine silicas as a threat to carbon black, Dr. Sweitzer declared.

In conclusion, he said that there seems to be no indication of a major shift in the distribution of these various reinforcing pigments in the next few years, unless new rubbers are introduced with basically different pigment requirements.

Dr. Tuley spoke on "growth prospects for rubber processing chemicals," which he placed in two principal categories, that is, those chemicals used in the manufacture of synthetic elastomers, and those used in the conversion of elastomers into fabricated rubber products. The major factor in the growth of rubber processing chemicals is therefore the volume of synthetic elastomers produced and the quantity of all rubbers consumed in the rubber products industry.

An increase of about 12% in the production of synthetic elastomers in the next three to five years in the United States was predicted, and a slight increase in the percentage of synthetic rubber in domestic consumption was forecast.

This speaker then discussed the chemical types and functions used in polymer production including emulsifiers, peroxide catalysts, mercaptan modifiers, shortstops, and stabilizers. He then classified compounding ingredients by their functions such as plasticizers, vulcanizing agents, antioxidants, etc.

Factors influencing the growth of rubber chemicals included increased volume resulting from increased rubber use, acceptance of products performing new functions, introduction of products with more effective or desirable characteristics, and changing proportions of usage of the various synthetic elastomers, it was said.

The manufacture and the sale of rubber chemicals are well dispersed among a number of larger and smaller chemical companies and several rubber companies. Alertness and fast action are required to meet the changing needs of the rubber industry, Dr. Tuley concluded.

Dr. Winkelmann spoke on trends in the use of plasticizers, extenders, natural and synthetic resins, and reclaimed rubber in elastomeric compositions. Indicating that no accurate statistics were available, he presented his own estimates, based on consultations with various manufacturers of these products.

He explained the types of plasticizers used with natural as compared with styrene-butadiene rubber (SBR). Assuming that 7% plasticizers and extenders per 100 parts of natural rubber are used, their total consumption in

1957 was about 77 million pounds. If it is assumed that 37½ parts of oil per 100 parts of SBR is used in oil-extended SBR, about 200 million pounds of oil were consumed in 1957 for this purpose. If it is assumed that 20 parts of plasticizers and extenders are used in compounding regular SBR, the 1957 consumption of these materials was estimated at 234 million pounds, broken down as follows: mineral rubber, 40 million pounds; vulcanized vegetable oil, 7 million pounds; cumar and petroleum resins, 50 million pounds; rosin, 29 million pounds; and miscellaneous oil-type plasticizers, 108 million pounds. Thus, all plasticizers and extenders used in SBR and natural rubber in 1957 amounted to about 511 million pounds.

Revolutionary developments in the large-scale plasticizer-extender field seem unlikely because of low permissible costs, it was said. New product requirements or new synthetic rubbers may, however, bring various changes.

The plasticizers and extenders used in neoprene, assuming about 15 parts on 100 of this rubber, include 22 million pounds of light process and heavier aromatic petroleum distillate oils, 2.5 million pounds of ester plasticizers, and 0.5 million pounds of cumars and petroleum resins, for a total of 25 million pounds, again for the year 1957.

For nitrile rubbers in 1957, plasticizer consumption was considered to be as follows: phthalates, 3.1 million pounds; polymeric types, 1.9 million pounds; sebacates, oleates, adipates, 0.9 million pounds; and phosphates, 0.4 million pounds; for a total of 6.3 million pounds.

Plasticizers for butyl rubber amounted to 27 million pounds of paraffinic oils, and 1.7 million pounds of low iodine oils, petrolatum, waxes, sebacates, and adipates in 1957, for a total of 28.7 million pounds.

It was mentioned that about 10 million pounds of phenolic resins are consumed annually in all elastomers. Two million pounds per year of such resins are blended with nitrile rubber and sold as a compound to give tough products with high impact strength.

Dr. Winkelmann also considered the recent trends in the use of powdered and pelletized reclaimed rubber. About 5% to 10% of the reclaimed rubber consumed is in the form of premix in which carbon black, plasticizers, clay, whiting, etc., are added prior to refining. While the premix reclaim is not new, the volume of this type has been increasing because of its advantages in highly competitive products.

In concluding, this panelist described briefly blends of reclaimed rubber and resins, new uses for reclaimed rubber, Hi-Sil LM-3 silicone oil-treated filler, polyethylene oxides as latex coagulants, and the use of low molecular weight polyethylenes as processing aids for elastomeric compounds.



Gerard W. Kuckro

Kuckro New Member, RW Editorial Board

Gerard W. Kuckro, consultant in the materials and processing laboratory, wire and cable department, General Electric Co., Bridgeport, Conn., has joined the Editorial Advisory Board of RUBBER WORLD as of May 1. Mr. Kuckro replaces John H. Ingmanson, vice president of the Whitney Blake Co., who resigned from the Board after having served since January, 1956, during which time he contributed much to our editorial program.

The new Board member has been associated with General Electric since 1949. In 1948 and 1949 he was assistant to the president of Molded Latex Products, Inc., and from 1946 to 1948 he was technical superintendent of Cords, Ltd. Mr. Kuckro was also technical superintendent for the Royal Electric Co. from 1943 until 1946. He was employed by Revertex Corp. of America from April, 1935, until 1943 and was factory manager.

Mr. Kuckro is a graduate of St. John's University and also spent one year at Columbia University doing graduate work in chemistry. He is a member of the American Chemical Society and its Rubber Division, the Connecticut and New York Rubber groups, and Veterans of the Seventh Regiment. He resides in Fairfield, Conn.

SRG June Meeting

The program for the next meeting of Southern Rubber Group, scheduled for the Dinkler Plaza Hotel, Atlanta, Ga., June 13 and 14, has been announced. There will be a panel discussion on polyurethane foams on the afternoon of June 13, and the panelists and their

subjects will be as is given below:

"The Chemistry and Present Position of Flexible Urethane Foams," by L. W. Schnuelle, Hewitt-Robins, Inc.

"The Chemistry of Rigid Urethane Foams and Mechanical Foaming Apparatus," Benjamin Collins, Nopco Chemical Co.

"Thin-Section Urethane Foam Casting," H. B. Townsend, General Latex Chemical Corp.

The panel discussion on reclaimed rubber will be held on the morning of June 14, and the panelists and their subjects in this case will be:

"Reclaimed Rubber in Molded and Other Non-Transportation Items," by John E. Brothers, Ohio Rubber Co.

"What Is Reclaimed Rubber and How Is It Made?", John M. Ball, Midwest Rubber Reclaiming Co.

"What Are Premixes and How Are They Used?", John R. Meisner, Xylos Rubber Co.

"Reclaimed Rubber in Tires and Other Transportation Items," Earl B. Busenberg, B. F. Goodrich Co.

"What Types of Reclaimed Rubber Are Available?", T. H. Fitzgerald, Naugatuck Chemical Division, United States Rubber Co.

"What Are Major Reasons for Using Reclaimed Rubber?" Croft Huddleston, U. S. Rubber Reclaiming Co.

This year's chairman of the SRG is Thomas R. Brown, B. F. Goodrich Co., Tuscaloosa, Ala.

Emmett Wins Award

Professor Paul H. Emmett, of The Johns Hopkins University, and one of the nation's leading physical chemists, received the \$1,000 Kendall Co. Award in Colloid Chemistry on April 14 at San Francisco, Calif., during the 133rd national meeting of the American Chemical Society.

Dr. Emmett is internationally recognized for his extensive research on the adsorption of gases and on catalysts, agents which control the speed of chemical processes. He gave his award address on "Adsorption and Catalysis" before the Society's Division of Colloid Chemistry in the Whitcomb Hotel on April 16.

The award, which includes a certificate is sponsored by the Kendall Co., Boston, Mass., and was established in 1952 "to recognize and encourage outstanding contributions to the science of colloid chemistry in the United States and Canada."

Dr. Emmett was honored for his contribution to the famous Brunauer-Emmett-Teller method for determining the surface areas of finely divided or porous materials. This method is a powerful tool for chemists and chemical engineers in research and production.

Rubber Division, CIC, May 28, Toronto Program

Upwards of 1,500 chemists and chemical engineers and others engaged in related activities are expected to attend the forty-first annual conference and exhibition of The Chemical Institute of Canada, to be held at the Royal York Hotel, Toronto, Ont., Canada, May 26-28. The Division of Rubber Chemistry will hold morning and afternoon technical sessions on May 28, at which nine technical papers will be presented.

One of the features of the CIC conference will be the presentation of the CIC Medal to Dr. Carl A. Winkler, McGill University, Montreal, P.Q., in recognition of his outstanding contributions to chemistry. The Medal, made of palladium, is provided by The International Nickel Co. of Canada, Ltd., and this year is being awarded for the eighth time. Dr. Winkler has chosen "Active Nitrogen" as the subject of his Medal address.

The exhibition will consist of the latest developments in laboratory and chemical process equipment, scientific instruments, chemicals, and technical literature. Fifty-five manufacturers and distributors will take part in this display, the only one of its kind in Canada.

Abstracts of the Rubber Division papers are published below.

Wednesday, May 28, Morning Wray Cline, Canadian General Tower, Ltd., Presiding

"Factors Influencing Cut Growth Testing." W. A. Gurney and I. C. Cheetham, Dunlop Research Center, Birmingham, England.

A modified Rainier-Gerke apparatus has been used for measuring cut growth. In this test the rate of growth of a standard cut initiated in a grooved test piece is studied as a function of flexures between defined angles, which can be changed as desired. As in other similar tests, a wide variability is associated with the results. Work, started as an investigation of possible sources of test variability, has led to information on factors dominant in cut growth.

The rate of cut growth is shown to be dependent upon the flexing angle and critically dependent on the minimum angle. The growth rate shows a sharp peak at small positive values of minimum angle and subsidiary peak at small negative angles. These observations are explained on a theory of molecular chain entanglement and permanent set.

It is found, furthermore, that the cut growth rating of compounds of different polymers can be changed or even reversed by modifying the initial and final angles between which the samples are flexed.

Other experiments have shown that the rate of cut growth is affected by prescorch before cure; a very short prescorch, surprisingly, proves beneficial.

"Studies of Synthetic Polymers with the Electron Microscope." W. Rupar and L. Breitman, Polymer Corp., Ltd., Sarnia, Ont., Canada.

The large magnifications available with the electron microscope have made it possible to examine structural features of synthetic polymers in their different states. The determination of particle sizes and the distribution of a latex is of considerable technical and theoretical importance.

A latex with a narrow particle distribution has been prepared and is used as a calibration standard. Accurate analysis of particle size distribution of *Hevea* and special synthetic latices with wide distribution presented a sampling problem. A fractional creaming technique has been developed to prepare samples which are easily analyzed.

Extensive use was made of positive carbon replicas to examine packing characteristics of film forming latices with or without pigments. The electron microscope was also used to measure the particle size distribution of rubber fillers. Techniques have been evolved to determine the state of aggregation and dispersibility of various fillers which are added to the rubber.

"Effects of Radiation on Raw and Vulcanized Elastomers." T. C. Gregson, W. R. Miller, L. B. Bangs, S. D. Gehman, Goodyear Tire & Rubber Co., Akron, O.

Radiation cured rubber has not yet shown physical properties comparable to those obtained through thermal vulcanization. In searching for ways to improve radiation vulcanization, a study was made of the effect of the following variables on the physical properties of radiation cured elastomers: (1) tread stock ingredients, (2) radiation damage inhibitors, (3) initial molecular weight, and (4) environment.

Tread stock formulations give superior properties in radiation vulcanization compared to the black masterbatch, an effect attributed almost entirely to the zinc oxide. Some radiation damage inhibitors, when incorporated in the raw compounds, give improved properties in the vulcanizates, but may also inhibit cross-linking during the early stages of vulcanization. A certain amount of milling before irradiation seems beneficial; excessive milling leads to an inferior product. Stocks exposed in air and in nitrogen have shown no significant differences in rate of cross-linking or in properties.

Heat vulcanized elastomers have been irradiated to investigate the effects of (1) environment, (2) state of cure, (3) radiation damage inhibitors, and (4) post-irradiation changes on the physical properties of such stocks. Exposure in nitrogen results in less damage than an equivalent dose in air.

The temperature during irradiation is a significant factor in radiation damage.

"Some Studies on the Dispersion of Carbon Black in Rubber." C. W. Sweitzer, W. M. Hess, and J. E. Callan, Columbian Carbon Co., New York.

The importance of adequate dispersion of carbon black in rubber compounds has long been recognized. The various facets of this subject are reviewed, with particular emphasis on the studies carried out in the laboratories of Columbian Carbon Co.

A practical and useful photographic method for measuring the macroscopic state of carbon black dispersion in rubber stocks is described. These macroscopic dispersion differences are shown to play a major role in the performance of most factory compounds, particularly tread stocks. Microscopic methods employed for the investigation of the ultimate state of carbon black dispersion are also described, and the results discussed in terms of relation to compound properties.

With these techniques employed, the effect of various factors on the state of dispersion was investigated. These factors included the type of polymer, the grade and loading of carbon black, a variety of dry mixing procedures, and wet masterbatching. The advantages in terms of compound properties, resulting from good dispersion of carbon black, are summarized. The role played by the state of carbon black dispersion in the development of reinforcement is discussed briefly.

"Recent Advances in Rayon Tire Yarn." A. Sandig, Courtaulds (Canada), Ltd., Cornwall, Ont., Canada.

Factors stimulating the demand for stronger and better tire cords such as more powerful cars, super highways, changed driving habits, power steering and power brakes, lower inflation pressures, and 14-inch wheels are reviewed.

This challenge is being met by the rayon tire yarn industry through constant improvement of its product. Development of improved, super, super super tire yarn types as well as the new rayons is discussed. The outstanding tensile and fatigue resistance properties of the new rayons are described, and the possible applications of their properties for making better and more economical rayon tires are suggested. The recent progress in rayon tire yarn is ascribed to the intensive research in both spinning technology as well as the fine structure of cellulose and regenerated cellulosic fibers.

The relation between the mechanical properties of tire yarns and the fine structure parameters such as orientation, crystallinity, lateral order, secondary swelling, and degree of polymerization are also discussed.

The technical and economical advan-

tages of rayon tire yarn are summarized, and further progress is projected on the basis of the recent rapid advances in spinning techniques and in fundamental knowledge of pulps and cellulosic fibers.

L. T. Rosser, of Mansfield Rubber (Canada), Ltd., will be the luncheon speaker.

Wednesday, May 28 Afternoon
Wilf Jonah, Louis Specialties, Ltd.,
Presiding

"Factors Affecting the Physical Properties of Furnace Black/Butyl Rubber Vulcanizates." D. F. Walker, E. M. Dannenberg, and B. B. S. T. Boonstra, Godfrey L. Cabot, Inc., Cambridge, Mass.

A study has been made of the factors affecting the behavior of furnace blacks in butyl rubber. Among these are the loading of the black in the compound, the recipe used, the effect of heat treatment during mixing, and chemical nature of the black surface.

"Lignin-Rubber Technology." D. W. MacGregor, L. H. Krichew, and T. R. Griffith, National Research Council, Ottawa, Ont., Canada.

Although lignin may be used as a substitute for carbon black in many rubber products, including tires, it is different from carbon black in compounding requirements. Lignin, coprecipitated with rubber from latex by the addition of acid, may be looked upon as an organic acid and, as such, has a delaying effect upon vulcanization. This delaying effect is not due to the acid as such, but to H_2S , which is developed in excessively large portions during vulcanization in an acid medium. Certain metallic oxides, such as those of lead, copper, and bismuth, which have superior ability to precipitate H_2S in an acid medium, have the ability to counteract acidity in rubber far beyond what would be expected solely from their ability to neutralize acid.

Vulcanization of lignin compounds is preferably carried out with strong acceleration. There are advantages in the use of metallic oxides such as those just mentioned, particularly litharge. If slow cures are desired, as in tire compounds, strong accelerators are still advisable, but in reduced quantity. Sulfur dosage should also be reduced to a minimum of about one phr.

Factory processing requirements will be discussed, and the differences in physical properties between factory-prepared and laboratory-prepared compounds will be pointed out.

Oxidized lignin powder, although it is not hygroscopic and will lose adsorbed water on contact with air, still has an enormous capacity for water. Such powder is dry in appearance and flows freely when containing up to 100% of its own weight of water. Oxidized lignin powder, in quantities about five phr., may be thus used for adding

water to rubber compounds, and when this is done, the expected increased cure rate is obtained.

"Maleic Anhydride Modified Elastomers." H. W. Paxton, R. H. Snyder, P. F. Gunberg, and P. O. Tawney, United States Rubber Co., Wayne, N. J.

This paper describes practical laboratory and pilot-plant methods for the preparation of several maleic anhydride modified natural and synthetic elastomers. The rubber produced by these methods are substantially free of gel. New curing systems for these chemically modified rubbers are discussed, and changes thereby produced in the physical properties of the vulcanizates are presented. For example, under certain conditions, enormous improvements in flex life and tear resistance are effected.

"The Pneumatic Tire — Yesterday, Today, and Tomorrow." J. E. Corey, Firestone Tire & Rubber Co., Akron.

Since the discovery of the wheel, it was pre-ordained that rubber would play an important role in the transportation of man and his materials. Hand in hand with the expansion of

our civilization we have built more highways and demanded speed in even greater measure. The part played by the rubber tire in meeting these requirements is a story of constant search for new materials, better application and engineering of a product which is a cornerstone in the structure of transportation throughout the world.

As advances and improved products are made available, it is the responsibility of the rubber industry to educate the using public. The people must be taught how to use the product safely and economically. They must be taught to recognize its limitations as well as its capabilities. Tires as we know them today deal with a range of sizes from the small industrial which can be held in one hand to the giant earth-movers, some of which are up to ten feet in diameter, four feet across, and weighing more than $1\frac{1}{2}$ tons. From this wide range of tire sizes and specialized types we must know how to select the proper one for our job and how to use it once the investment is made.

It is the intent of this paper to familiarize the public with aspects of the tire industry and tire application so they may use the product to a better advantage.

Atomic Energy Management Conference

Irradiation can be used to create useful new chemicals known as graft copolymers, and to vulcanize rubber, according to a paper presented by R. B. Mesrobian, associate director of research, central research and engineering division, Continental Can Co., at the Atomic Energy Management Conference cosponsored by the National Industrial Conference Board and the Atomic Industrial Forum at the Palmer House, Chicago, March 17-19. In a session on potential applications for large sources of radiation, Mesrobian reviewed the general effects of ionizing radiation on rubbers, plastics, fibers and resins, and also made the following points.

The irradiation of polymers by gamma- or X-rays in the presence of common vinyl monomers results in the formation of graft copolymers wherein the monomer component is chemically combined or grafted to the backbone of the starting polymer. A number of unique radiation induced graft copolymer systems have been developed which manifest useful properties. These include: (1) polyethylene containing grafted vinyl carbazole to produce a heat-resistant dielectric material; (2) silicone rubber containing up to 34% acrylonitrile to improve oil resistance of the elastomer; (3) Teflon containing surface grafting of styrene to improve adhesion to surfaces; (4) and cation and anion exchange resins derived by grafting vinyl pyridine to polyethylene or styrene to polyethylene

followed by the introduction of sulfonic acid or quarternary amine groups to the styrene units. In the latter case, the ion exchange resins are used as permeaselective membranes for removal of salt from brackish water and sea water. Data are presented on the properties of the above-mentioned systems as well as the conditions and mechanisms for inducing radiation grafting.

Concerning the vulcanization of unsaturated polymers such as natural and synthetic rubbers by gamma-rays, it is generally found that in the absence of any added organic reagents a dosage on the order of 30 megarads is required to effect complete vulcanization of the network chains. In the presence of monomeric materials such as p-chlorostyrene, however, the required dosage to effect gelation can be reduced to 1.05 megarads. The profound increase in efficiency of radiation vulcanization is attributed to several factors which include an increased average life-time of radicals in the rubber system by chain transfer to monomer and subsequent interaction of growing chains with segments of the rubber molecule. There are important factors to bear in mind in considering the efficiency and overall economics of radiation induced processes.

The NICB-AIF Atomic Energy Management Conference was held in conjunction with the 1958 Nuclear Congress and the AIF Atomfair at the International Amphitheater, Chicago, Ill., March 17-21.

SRG Panels on Carbon Black and Molding at Houston



Members of the carbon black panel at the Southern Rubber Group

The Southern Rubber Group, meeting February 21 and 22 at the Shamrock-Hilton Hotel, Houston, Tex., featured two panel discussions of interest to rubber technologists. The first panel was concerned with "Carbon Black Reinforcement of Rubber", while the second discussion was on "Molded Rubber Goods."

The moderator of the carbon black panel was R. A. Emmett, Columbian Carbon, and the panel members were M. L. Studebaker, Phillips Chemical Co., Akron, O.; Henry J. J. Janssen, The General Tire & Rubber Co., Akron; and Carl W. Snow, United Carbon Co., Inc., Charleston, W. Va.

William Horn, Guiberson Corp., Dallas, Tex., served as moderator of the molded goods panel, with G. C. Hessney, The B. F. Goodrich Co., and R. P. Mitchell, Goodyear Tire & Rubber Co., both of Akron, as panel members.

A feature of the dinner program, held the evening of February 21, was the presentation of a specially engraved silver cup to John Bolt, Naugatuck Chemical Division, United States Rubber Co., as the Southern Rubber Group's "Man of the Year." Thomas R. Brown, B. F. Goodrich Tire Co., made the presentation.

The after-dinner speaker was Lewis Rigler, of the Texas Rangers, whose topic was the history and the organization of the Rangers.

Summaries of the papers presented at this meeting are given below.

Carbon Black Panel

The Chemistry of Carbon Black in Rubber. M. L. Studebaker.

There are two routes to the study of carbon black reinforcement of rubber, the chemical and the physical. This paper was concerned with the chemical approach to carbon black reinforcement.

The interaction between carbon black and the rubber hydrocarbon leads to the formation of bound rubber or carbon-gel. Bound rubber is a chemical rubber-carbon black complex of unknown structure. This bound rubber or

carbon-gel tends to preserve the agglomerated condition of carbon black during vulcanization.

Vulcanization reactions are catalytically promoted by carbon black. The movement of rubber is restricted, however, by its intrinsic nature and by adsorptive forces—both physical and chemical. These combined actions lead, the speaker feels, to an abnormally high concentration of cross-links in the immediate vicinity of the carbon black surface.

Thus the assumption of homogeneous distribution of cross-link densities from measurements of swelling or equilibrium modulus is incorrect, this speaker suggested.

Discussion of the Physical Aspects of the Reinforcement of Elastomers by Carbon Black. H. J. J. Janssen.

The premise that high modulus is not just a side effect of reinforcement, but an essential requirement was thoroughly explored.

Wiegand's¹ investigation of the energy relations in breaking of rubber and more recent work on the mechanism of abrasion seem to support this view. The Mullins² "effect," however, does cast some doubt on the importance of the role of modulus in rubber reinforcement.

Both rubber crystallites and carbon

black enhance the physical properties of the rubber matrix. The action of these two modes of reinforcement are supplementary in carbon black reinforced rubber. Carbon black causes modulus at low elongation to increase and may be the main reason for the success of carbon black in tire tread compounds.

A survey of the existing literature suggests that the reinforcing action of carbon black in elastomers is due to an increase in the energy required to give a "certain" stress on the chains; causes a more even distribution of stress over the chains; and forms a network structure with the rubber crystallites that is highly resistant to tearing.

Concerning the Reinforcement of Rubber by Carbon Black. C. W. Snow.

Some concepts of solid-state physics have been used to launch an attack on the mechanism of carbon black reinforcement of rubber.

The carbon black particle is pictured as a defect-state relative to graphite. The graphite structure is considered to be the base state of zero energy, and the defect-state (carbon black) of higher energy levels.

It is postulated that carbon black particles, because of their high energy levels, are capable of distorting the electron configuration of the rubber hydrocarbon. These "electronically strained" portions of the rubber hydrocarbon chain, containing local electron excesses and deficiencies, are assumed to act as dipoles and grip each other in a reinforcing grasp.

Molded Goods Panel

Rubber Molding Techniques and Equipment. G. C. Hessney.

Three molding techniques are used by the rubber industry: compression molding, transfer molding, and injection molding.

Compression molding, the time-hon-



Southern Rubber Group's molded goods panel

¹Ind. Eng. Chem., 17, 939 (1925).

²Trans. Inst. Rubber Ind., 32, 231 (1956).

ored method, is characterized by preparing the rubber stock to the approximate shape (and weight) and placing it directly into the mold cavity.

In transfer molding a predetermined weight of rubber stock is placed into a pot or loading-well, which is an integral part of the mold, and forced through sprues into the mold cavities.

Injection molding is a similar technique in that part of the rubber in the chamber is forced by pressure into the mold cavities. In this case, however, the injection reservoir is not an integral part of the mold.

Many complex rubber parts cannot be compression molded, and transfer or injection molding is necessary.

The advantages of transfer molding, as compared to compression molding, are less mold maintenance, reduction of curing time, less rind or flash, close control of weight not so necessary, and more complex parts may be fabricated.

The transfer molding process is not all "beer and skittles." There are some disadvantages, among which are increased mold cost, reduced number of mold cavities, cure rate more critical than for compression molding, rubber products containing fabric cannot be molded, and considerable residue left as waste in the loading-well.

Injection molding apparatus is of two general types: (1) the injection equipment moves into the mold location; (2) the injection unit is fixed, and the molds must be moved into the injection area and thence into a press or heating oven.

The first method is more expensive to maintain, while the second method requires costly mold handling.

Today's use of injection molding has been limited to production of those rubber products where a continuous operation is possible and where the product cannot be economically made by either compression or transfer molding.

Mold design is the very heart of the molded goods industry and the molded goods engineer's main concern. Recent developments in mold design include the use of transfer molds with no rind or flash on the cured part; arrangements whereby metal inserts serve as part of the bearing surface; permanent magnets to place and hold metal inserts; strong metal springs to facilitate mold opening and plunger plate removal; and use of transfer-pots and plungers with several different transfer molds.

A recent development, in molded goods production is an automatic turntable fabricating system for small rubber parts (under two-inch diameter). In this system a rubber strip is fed from a roll mill into an area between two drums (each of which is equipped with matched halves of the molds around its periphery) which die out of the strip enough rubber to fill each mold. The molds are heated, and when the rubber part becomes semi-cured, it is ejected from its mold on to a moving conveyor belt. The part is then



John Bolt (left) receives Southern Rubber Group's "Man of the Year" Award from T. R. Brown, chairman

finish-cured in a heating unit. The excess rubber stock is cycled back on to the roll mill, and the process continuously repeated.

Compounding Variables and Problems in the Molded Rubber Products Industry. R. P. Mitchell.

The ability of a manufacturer to produce quality molded rubber products depends to a large extent on his ability to analyze and correct the many compounding problems and variations that occur in the manufacturing process. These problems and compound variations start with incoming materials and extend throughout the complete manufacturing process.

It is convenient to relate these problems and their solution to the three basic operations of molded goods production: namely, mixing, stock preparation, and curing.

The mixing operation is important in order to achieve optimum properties in the finished product. Good dispersion of compounding ingredients is the major problem. Banbury batch size, order and time of addition of compounding ingredients are important variables at this stage of operation. Secondary to Banbury mixing, but nevertheless requiring attention, is the rapid removal of stock from the sheet-out mill and its subsequent cooling.

Preparation of stock for curing generally consists of tubing, calendering, or slabbing. The tubing operation requires complete compound "breakdown"; otherwise die swell occurs which will result in non-uniform sizes and weights of mold preforms. This is especially true when a cutting operation is employed in conjunction with the tubing operation. Care must be taken to avoid localized heat build-up during all stages of the tubing operation, which can be avoided to large extent by adjusting the rpm. of the tuber screw such that the extruder is full of stock at all times. A "starved

screw" creates excessive heat and results in scorched stock. Excessive screw clearance not only reduces output, but also contributes to heat build-up, with resultant scorch problems.

Calendering also requires complete compound breakdown. Roll temperature, roll speed, and discerning attention to compounding techniques are necessary to produce a quality calendered sheet. Proper tension on the "take-away" will prevent wrinkling and bagginess in calendering into rolls. On the other hand, tension should be removed if the calendered strip is fed to a cutter or is punched for a mold preform.

"Back rind," blisters, flow cracks, not-filled-out products, and appearance are all problems found in the curing operation. Many of these problems can be considered under the single problem of mold flow. Mold flow is influenced by the plasticity of the compound, curing system used, type and dispersion of fillers, mold lubrication, temperature of curing, preparation shape, cavity pressure, and mold design. Plasticity of the compound is subject to more variation than any of the other factors affecting mold flow. It is affected by all the variations in mixing stock preparation and incoming raw materials.

"Back rinding" is caused by the sudden release of pressure developed in the mold cavity by the thermal expansion of the compound during its rise to curing temperature. Preheating the preform, compounding to reduce thermal expansion, adjustment of rate of cure, and transfer or injection molding all serve to minimize "back rinding."

Many molded products have metal inserts incorporated in their design. As a result, problems of rubber-to-metal adhesion appear. Chemical cleaning of the inserts and immediate application of cement will cure most of these difficulties.

June Meeting

The next meeting of the SRG will be held in Atlanta, Ga., June 13 and 14. The session on the 13th will consist of a panel discussion on urethane foams, and the session on the 14th on reclaimed rubber is being organized by the Reclaimers Association, Inc.

New Rubber Catalyst

Callery Chemical Co., Pittsburgh, Pa., is now supplying trichloroborane, $(C_2H_5)_3B$, in 20-milliliter sample quantities for experimental studies. Larger quantities will be available this summer. This compound is a catalyst for polymerization of unsaturated monomers such as olefins, styrene acrylonitrile, and acrylic and vinyl compounds.

International Rubber Conference Papers Solicited

An International Rubber Conference sponsored jointly by the Division of Rubber Chemistry of the American Chemical Society, Committee D-11 on Rubber & Rubber-Like Materials of the American Society for Testing Materials, and the Rubber & Plastics Division of the American Society of Mechanical Engineers, will be held in Washington, D. C., at the Shoreham and Sheraton Park Hotels, November 8 through 13, 1959.

Because of the nature of the sponsorship of this Conference, it is expected that the program can be arranged to include papers in the broad fields of rubber chemistry and technology, the testing of rubber and rubber products, engineering in the rubber industry with special reference to equipment and processes, and rubber as an engineering material.

Conference and Program Committees

The Conference committee consists of three representatives of each of the sponsoring societies. A. E. Juve, of B. F. Goodrich Co. Research Center, Brecksville, O., and representing the Rubber Division, ACS, is chairman of the Conference committee, with B. S. Garvey, Jr., Pennsalt Chemicals Corp., and A. W. Sloan, Atlantic Research Corp., the other representatives of the ACS Rubber Division. Simon Collier, Johns-Manville Corp.; J. J. Allen, Firestone Tire & Rubber Co.; and H. G. Bimmerman, E. I. du Pont de Nemours & Co., Inc., represent ASTM Committee D-11. R. D. Stiehler, National Bureau of Standards; G. Bruggemeier, Firestone; and R. G. Seaman, RUBBER WORLD, represent the Rubber & Plastics Division, ASME. Mr. Allen is the Conference committee secretary.

The program committee is headed by Dr. Garvey, with Mr. Seaman as secretary. The other members of this committee are Dr. Stiehler; Mr. Bruggemeier; O. D. Cole, Firestone; J. D. D'Ianni, Goodyear Tire & Rubber Co.; C. F. Gibbs, B. F. Goodrich Co.; W. F. Tuley, Naugatuck Chemical Division, United States Rubber Co.; M. E. Lerner, Rubber Age; and G. C. Maassen, R. T. Vanderbilt Co.

Papers Solicited

The program committee is soliciting papers for the Conference and has set the following deadlines:

Title of paper, name and affiliation of author(s), and time required for presentation—October 1, 1958.

Abstract of paper (250 words, approximately)—January 1, 1959.

Completed manuscript (four copies)—June 1, 1959.

All correspondence with respect to papers should be addressed to **Dr. B. S. Garvey, Jr., Chairman, Program Com-**

mittee, International Rubber Conference, Pennsalt Chemicals Corp., 813 Lancaster Pike, Wayne, Pennsylvania, U.S.A.

Papers originating within the United States and its possessions must be sponsored by one of the three societies involved and shall meet the requirements of the sponsoring society with respect to membership of the author or authors and the quality standards of the pertinent society by its own review. Authors from outside the United States and its possessions are not required to be members of any of the American societies, and papers from overseas will be especially welcomed.

Suggested Conference Program

The following 12 classifications of subjects and their sub-classifications are suggested to authors wishing to contribute papers to the Conference program, but these classifications are not intended to be restrictive, and papers not falling directly under any of these classifications will be welcomed for consideration also.

1. Equipment and Processes in Rubber Manufacturing
 - (a) Automation
 - (b) New Equipment
 - (c) New Processes
2. Elastomers as Engineering Materials
 - (a) Vibration Dampers
 - (b) Sealants
 - (c) Materials Handling
3. Advances in Test Methods
 - (a) Small-Scale Testing
 - (b) Deterioration Tests
 - (c) Tests of Dynamic Properties
 - (d) Control Tests
4. Product Testing
 - (a) Tires
 - (b) Belting and Other Mechanical Products
 - (c) Foam and Sponge Rubber
5. Statistical Methods in the Rubber Industry
 - (a) In Research and Development
 - (b) In Testing
 - (c) In Production
6. Nomenclature and Classification
 - (a) General Terms
 - (b) Elastomers and Compounds
 - (c) Processes and Products
7. New Developments in Elastomer Reinforcement
 - (a) Carbon Blacks
 - (b) Mineral Products
 - (c) Resins
8. Compounding Developments
 - (a) Vulcanization
 - (b) Rubber Chemicals
 - (c) Special Applications
9. Polymers and Polymer Structure
 - (a) Stereospecific Elastomers
 - (b) Polyurethane Elastomers
 - (c) Elastomers for High-Temperature Use
10. Production of Rubber
 - (a) Plantation Practices
 - (b) Synthetic Rubber Production
 - (c) Elastomer Manufacture
11. Latex Technology and Foam Products

- (a) Dipped, Extruded, and Spread Goods
- (b) Foamed Rubber
- (c) Foamed Elastomers
12. Physics and Rheology of Rubber
 - (a) Viscosity and Flow Phenomenon
 - (b) Elasticity, Time, Temperature, and Frequency Effects
 - (c) Optical, Electrical, and Other Physical Properties

The program and Conference committees urge members of the sponsoring societies and other interested persons throughout the world to begin now to plan for papers to be presented at this Washington International Rubber Conference in 1959. Five years will have elapsed by November, 1959, since the Third Rubber Technology Conference of the Institution of the Rubber Industry of 1954 in London, and there will be many advances in rubber science, technology, and engineering that the Washington Conference should include.

Purdue To Give Course

An advanced short course in quality control by statistical methods will be held at Purdue University for the twelfth year in succession under the direction of Professor Irving W. Burr, June 10 to 20. This is one of two such advanced short courses; the other is being offered at UCLA, now in its third year.

The enrollment is limited to 50. This popular, intensive course is designed for those who have a background in control charts and acceptance sampling. The statistical techniques presented are of value to research workers as well as those concerned with quality of production.

The subjects covered in the 10-day period include significance tests and estimation, linear and multiple correlation and regression, single and sequential sampling for measurements, and analysis of variance.

A simplified and practical approach is used in this course by instructors experienced in teaching quality control to industrial men. Besides Dr. Burr, the staff includes Dr. Charles R. Hicks, Purdue University; Dr. Cecil C. Craig, University of Michigan; Dr. Lloyd A. Knowler, University of Iowa; Dr. Edwin G. Olds, Carnegie Institute of Technology; and Dr. Mason E. Westcott, Rutgers University.

A brochure of this short course explaining several of the industrial and research applications of the techniques which are taught may be had by addressing Dr. Irving W. Burr, statistical laboratory, Purdue University, Lafayette, Ind.

New York Group Meeting on New Elastomers

The program for the March 28 meeting of the New York Rubber Group consisted of a symposium on "New Elastomers" and was held at the Henry Hudson Hotel, New York, N. Y., with about 230 members and guests in attendance. C. V. Lundberg, Bell Telephone Laboratories, Group chairman, presided at the afternoon technical meeting and the evening dinner-meeting.

The speakers at the technical session were H. E. Railsback, Phillips Petroleum Co., who discussed "Properties of *Cis*-Polybutadiene"; O. C. Keplinger, General Tire & Rubber Co., who described "Genthane S—Its Compounding and Properties"; and T. D. Eubank, E. I. du Pont de Nemours & Co., Inc., whose subject was "New Developments in Viton Fluorinated Elastomers."

"New Elastomers"

Mr. Railsback began his talk by pointing out that the development of stereospecific catalysts has provided a number of new synthetic elastomers including *cis*- and *trans*-polyisoprenes, *cis*- and *trans*-polybutadienes, and various other polymers and copolymers of controlled structure. Whereas much attention has been given to the production of *cis*-polyisoprene (synthetic natural rubber) by such processes, equally interesting and perhaps commercially more significant products are the orderly polymers of butadiene. The monomer for production of these polymers is presently available in adequate supply, and no elaborate purification of present commercial-grade butadiene is required for use in solution polymerization processes.

The properties of a polybutadiene of about 94.5% *cis*, 1.8% *trans*, and 3.5% vinyl content were described. Carbon black reinforced vulcanizates display moderate tensile strength, low modulus and Shore hardness, and excellent hysteresis properties when tightly cross-linked. High *cis* configuration gives properties resembling those displayed by natural rubber in many respects, and rubbers having high *trans* configuration resemble balata or gutta percha. Polybutadienes with a *cis* content in the range of 70 to 80% have been shown to have very low freeze point and little tendency to crystallize after conditioning for extended periods at low temperatures.¹

Blends of *cis*-polybutadiene with natural rubber up to a ratio of 1:1 exhibit very satisfactory milling and extrusion characteristics, and the vulcanizates have good stress-strain properties at 80 and 200° F. with excellent hysteresis.

Cis-polybutadiene is readily produced in a solution polymerization process using a selected organometal catalyst, and this process is currently under study in a pilot-plant program. Tire

tests are under way, and more extensive tests are planned. Inasmuch as *cis*-polybutadiene blends readily with natural rubber to give good processing stocks with hysteresis and resilience properties at least equal to those of natural rubber, the major potential outlet for *cis*-polybutadiene may well be for use in such mixtures.

Dr. Keplinger said that Genthane-S is the designation given to one of the polyurethane elastomers developed by The General Tire & Rubber Co. The recommended curing system permits the use of conventional rubber processing equipment and schedules. Products made from this polyurethane elastomer may be expected to show excellent resistance to hydrocarbons, some esters, ozone, and oxygen, coupled with an excellent balance of physical properties including good performance at low temperatures and remarkable stability at temperatures up to 300° F. Genthane-S is not recommended for use in polar fluids. Abrasion resistance is expected to be good.

The gum may be loaded with a variety of pigments. Sulfur or a small amount of absorbed moisture is the principal hazard. Channel blacks, furnace blacks, dry clay, calcium carbonate, precipitated hydrated silica (Hi-Sil), and titanium dioxide have been incorporated in amounts up to 100 parts per hundred of gum.

Cure may be effected with a variety of reagents, among which dicumyl peroxide gives outstanding results. Stocks to be cured with this material are non-scorching and may be stored for months after extruding, calendaring, or milling. They cure in 45 minutes at 310° F. or 20 minutes at 320° F., for example, and require no aftercure.

Mr. Eubank explained that designers of aircraft and automotive equipment are imposing more and more stringent requirements of heat and fluid resistance on existing elastomers, and many conventional elastomers are no longer usable as temperatures rise from 300 to 400° F. and higher, and resistance to new heat-stable fluids and lubricants becomes necessary.

Viton A,² a copolymer of vinylidene fluoride and hexafluoropropylene, was introduced about a year ago as an elastomer which combines the desirable qualities of heat and fluid resistance. Viton synthetic rubber has a relatively high density and is offered in two viscosity grades.

Basic compounding principles for Viton A require an acid acceptor, a filler, and a curing agent. Hexamethylene diamine carbamate is a most satisfactory curing agent. The normal curing cycle requires 30 minutes in a press at 300° F., followed by 16-24 hours at

400° F. in an air oven to develop ultimate physical properties and resistance to deterioration. A wide variety of fillers including carbon blacks, clays, and silica compounds can be used. A combination of zinc oxide and dibasic lead phosphite or magnesium oxide alone can be used as acid acceptors.

Viton A-HV has been developed specifically for hydraulic hose and is of higher molecular weight and higher Mooney viscosity than Viton A. The higher-viscosity Viton A-HV tends to be less safe processing than Viton A, and a copper inhibitor, disalcylalpropylene diamine, has been found to be useful in reducing scorching.

The major uses of Viton thus far have been in O-rings, shaft seals, and packings where combined high temperature and fluid resistance is required. Preliminary results indicate that bladder-type fuel cells, suitable for service at 500° F., can be made. Cellular sealing strips, hose, protective clothing, wire insulation, and calking represent additional product areas where Viton commands growing interest, it was said.

Dinner Program

Mr. Lundberg mentioned the Group's June 5 outing, August 5 golf tournament and October 17 meeting in connection with future activities. He explained that the program for the October 17 meeting will probably cover the effect of gamma and electron radiation on elastomers and at the same time asked for additional subject ideas for future meetings.

Alan J. Pickett, editor, *Rubber & Plastics Age*, of London, England, was introduced. A scroll for services as past chairman was presented to H. J. Due, St. Joseph Lead Co., and the 1957 chairman of the group.

P. Murawski, Du Pont, introduced Eugene W. Boehne, professor of electrical engineering, Massachusetts Institute of Technology, whose interesting and unusual talk on "Nature, Art, and Arithmetic" concluded the dinner program. Dr. Boehne showed how many forces in botany, physics, astronomy, and engineering can be reduced to simple mathematical relations.

Tranquilizer for Plants

United States Rubber Co., New York, N. Y., has developed a chemical tranquilizer for plants. It will be marketed for use on selected crops for the first time this season. The chemical is N-meta-tolyl phthalamic acid and is called Duraset-20W. It is said to increase plant yields by reducing the effects of shock and stress caused by such conditions as heat spells, sudden cold snaps, prolonged rains, drought, or over-fertilization.

¹ RUBBER WORLD, Apr., 1958, p. 75.

² *Ibid.*, Nov., 1957, p. 250.

Short Talks at Northeastern Meeting

The April 15 meeting of the Elastomer & Plastics Group, Northeastern Section, ACS, held at Science Park, Charles River Dam, Boston, Mass., consisted of the Seventh Annual Short Talks Symposium of the Group, and was chairmanned by J. Laurence Powell, B. F. Goodrich Footwear & Flooring Co., with 100 members and guests present.

The first speaker was D. D. Wright, Goodrich Footwear & Flooring, whose subject was "Solution Viscosities of Certain PVC Polymers." He presented the theoretical background of viscosity measurements and its relation to molecular weight and reported measurements made on cyclohexanone solutions of various homopolymers and copolymers of varying molecular weights, chiefly Goodrich's Geons.

With high molecular weight polymers, a 5-7% solution was employed, and with lower polymers, a 15-20% solution was used. There was good agreement between specific viscosity, molecular weight, and optimum processing temperatures, and the method was in successful use as a control test for production purposes. It was shown that the high molecular weight materials were most sensitive to changes in molecular weight.

The second panelist was E. M. Dannenberg, Godfrey L. Cabot, Inc., speaking on "Chemical Cross-Linking of Polyethylene," who dealt with the properties of carbon-containing cross-linked polyethylene, after a short discussion of the history of polyethylene and the more recent Ziegler-type catalyzed materials.

Mr. Dannenberg pointed out that by itself moderate cross-linking produced a more insoluble product of more indefinite melting point and with very little environmental cracking, especially with the higher-density materials. Alkaline carbon blacks added to non-cross-linked polyethylene produce a condition that can be described as bound polyethylene, he said, with reduced solubility, reduction in the degree of crystallinity possible in the polymer, and improved resistance to environmental cracking, but only limited amounts may be used, owing to rapid increase in brittleness with increased load.

Cross-linking carbon black-loaded polyethylene, however, permits much higher loadings, adding cheapness to the product, increasing heat and solvent resistance, and permitting a wide range of electrical properties—from insulation to conductive-type compounds. There is an accompanying stiffness, with toughness, compared to the brittleness of non-cross-linked carbon-reinforced polyethylene. Wire insulation and pipe were two outlets suggested for these materials.

Mr. Dannenberg also discussed the free radical reactions that take place in

these processes, comparing them with high-radiation reactions, and showed with slides the effects of cross-linking on crystallinity, density, spherulite formation, Young's modulus, and brittle point.

The third speaker of the Symposium, A. C. Walker, Jr., Plastics Research Laboratory, MIT, spoke on "High-Speed Stress Relaxation Studies of Viscoelastic Materials." After discussing the energy changes that occur in simple and complex tests, and the errors resulting from estimating behavior at high speed or frequency by extrapolation from data secured at low speeds or frequencies, the speaker divided viscoelastic behavior into two categories—complex compliance systems and complex modulus systems. The former evaluate the creep function; the latter, the relaxation function of materials deformation.

Mr. Walker then described the equipment used in his studies, which, by means of special strain gages and a fast-acting valve connected to an air reservoir, actuated a cylinder attached to the samples, permitting very rapid expansion or compression tests. The resultant effects were recorded on high-speed recorder charts. Motion up to about 10 feet per second, corresponding to a range of 25-50,000 cycles per second, was employed.

He reported that his studies with vulcanized elastomers indicated that creep was insensitive to local structure of the sample; whereas high-speed deformations were dependent on the local parts involved. He compared natural rubber and butyl rubber behavior at high and low speeds of deformation in illustration of this point.

The final speaker of the evening was J. W. Jackson, Jr., Bird & Son, Inc., who dealt with "Elastomer-Modified Asphalts." His research was aimed at improving the adhesion of granulated aggregate to 224° F. blown Venezuelan asphalt, and the reduction of its embrittlement with age. This was secured with the addition of 1½-3% of various elastomers by several methods and was considerably influenced by the presence or absence of a dispersing oil of their own manufacture.

The easiest method of incorporation was by treating latex with 100-300% of a mineral filler (barytes, talc, sericite mica) and coagulating, then adding the dried powder to the asphalt. When added directly, latex causes prolonged foaming.

The speaker illustrated the dispersion effects secured with various procedures by means of colored slides that clearly indicated degree of dispersion and elastomer structure on a bright red background.

Addition of SBR, neoprene, polybutadiene, and butyl rubbers, as treated latices or as solid pieces, had very

different effects on softening point, Barber impact brittleness, Instron pull-out strength (toughness), and ductility. In most cases the use of dispersing oil caused marked improvement in desirable properties.

The major drawback to the use of this method of increasing asphalt product life and performance was the doubling or tripling of product cost, when treated or untreated latex was employed, respectively.

There was a short question-and-answer period after each talk. The dinner and social hour preceding the Symposium were attended by 95 members and guests.

The final meeting of the season of the Elastomer & Plastics Group will be held on May 20 at Science Park, at which time a special program, arranged by E. E. Ross, T. C. Ashley Co., will celebrate the tenth anniversary of the founding of the Group by the late Ernst A. Hauser of MIT. Speakers will include Howard A. Reynolds, Dewey & Almy Division of W. R. Grace & Co., second chairman of the Group, who will describe the founder's work of organizing the Group; and Robert G. Seaman, editor, RUBBER WORLD, who will report on the future for commercial synthetic rubbers.

Fort Wayne Meeting

The Fort Wayne Rubber & Plastics Group held its fourth meeting of the 1957-58 season at the Van Orman Hotel, Fort Wayne, Ind., on April 10. There were 184 members present at the meeting and smorgasbord dinner.

The following were elected as new officers and directors for the 1958-59 season: P. Magner, Jr., The General Tire & Rubber Co., chairman; W. Wilson, R. T. Vanderbilt Co., vice chairman; A. C. Bluestein, Anaconda Wire & Cable Co., secretary-treasurer. Directors elected for a two-year period were: R. C. Knapp, United States Rubber Co., R. K. Mack, Western Rubber Co., J. B. Porter, H. Muehlstein & Co., Inc., and S. D. Shaw, Witco Chemical Co.

New officers will take office June 7, 1958.

A moment of silent prayer was given for deceased members, James Q. McGiffin, General Tire, and Ray Dumont, U. S. Rubber.

The speaker of the evening was O. C. Keplinger, General Tire, Akron, O., who talked on "Polyurethane Elastomer—Genthane S" and showed slides to illustrate his talk. The talk was the same as the one he presented before the New York Rubber Group on March 28 (see this issue, page 280).

The next meeting will be at Lake Tippecanoe, Leesburg, Inc., which will be the Group's summer outing on June 6.

Rhode Island Rubber Club Hears Hunt

TABLE I

| Property Desired | Elastomer | Filler | Processing |
|-------------------------|---|--|---|
| Low water absorption | Butyl SBR (1503-1019) | Avoid hydrophilic materials | |
| High resistivity | Low water absorbing polymers. Avoid rosin extender polymers | Low carbon black loading. Avoid structure blacks | |
| Dielectric strength | Little effect | Small particle size | Use extreme cleanliness in processing. Adjust cure to avoid porosity during vulcanization |
| Corona resistance | Hypalon Silicones Butyl Neoprene SBR Natural Rubber Note: These elastomers are listed in a decreasing order of resistance to ozone with Hypalon as best | Compound for rapid stress-decay | |
| Electrical conductivity | Little effect | Conductive channel and furnace blacks. Graphite. Metal powders | Prepare a low viscosity mix. Use low mixing speeds. Use short and uniform mixing and processing times |

The annual spring meeting (April 10) of the Rhode Island Rubber Club was held at the Pawtucket Country Club. Attending the combined technical and social session which included a cocktail hour and dinner were 254 members and guests. Among the highlights of the evening was an illustrated narrative by Norris Hoyt of his adventures in sailing in the Bermuda race of 1956 and his subsequent sail to Sweden.

Gilbert Enser, Collyer Insulated Wire, retiring chairman of the Club, was presented with a briefcase by the 1958 chairman, W. K. Priestley, of Kaiser Aluminum.

The technical portion of the meeting consisted of a talk by George Hilton, which was primarily a movie prepared by the Underwriters' Laboratories showing the functions of that organization, and a paper by George Hunt titled, "Design Factors in Compounding for Wire and Cable Applications."

There are three main classifications into which rubber insulation for electrical service more or less naturally falls, Mr. Hunt said. These are power cable insulation, communication cable insulation, and electric cable jackets.

In general, power cable is of thick cross-section; therefore, except under unusual circumstances, it need not have high strength. Excellent heat aging and resistance to very high temperatures for a short time (in case of a short circuit) are required. The usual tests to be passed by these compounds are various bomb tests (oxygen bomb, 80° C., and

air bomb, 127° C.) and oven aging tests (100 and 121° C.).

The electrical properties are, Mr. Hunt stated, very important. For 600 volt to possibly 10 KV service a stable dielectric constant of 6 or 7 and a stable power factor of 15% are probably minimum values. Above 600 volts high resistivity is necessary, and megohm constants of 1,000 or higher are required. Good dielectric strength is necessary and is obtained by avoiding large amounts of carbon black, especially structure black, in the compound. In addition the compound must have moisture stability and good aging properties. Last, but not least, all cable, and particularly power cable, must exhibit good resistance to ozone cracking and corona discharge. There are two routes to obtaining corona resistance: one is by selecting an elastomer with low unsaturation (Hypalon,¹ silicone, or butyl² rubber), and the other is compounding for rapid stress-decay.

Communication cables operate at relatively low voltages (up to 600 V) and require thin insulation walls, with low dielectric constant, high resistivity, low power factor, and good resistance to moisture absorption. Corona resistance is not important to communication cable compounds unless the cable is to be installed in an area of high ozone concentration.

Cable jackets, Mr. Hunt pointed out, are subject to mechanical abuse, heat, corona, moisture, oils, and various other corrosive chemical fluids. In some instances flame resistance may be required. High or low electrical resistance may also be a requirement.

Mr. Hunt closed his talk with some

suggestions for compounding for specific properties which are summarized in Table I.

The next meeting of the Club, a summer outing, is planned for June 5 at the Pawtucket Country Club.

Washington RG Meets

The Washington Rubber Group held a dinner-meeting on April 16; the cocktail hour and dinner were held at the National Press Club, followed by the technical session at Pepco Auditorium, Washington, D. C. The speaker at this session was John H. Garrett, chief of materials, division of research and engineering, Office of Assistant Secretary of Defense for Research and Development, who spoke on "A Phase of the Material Research and Development Program of Department of Defense."

According to Mr. Garrett, rubber, and organic materials generally, are taking something of a back seat in defense research materials at the moment. The Defense Department's research scientists are devoting their main efforts toward solving structural problems of new weapons systems. This means development of basic new materials such as beryllium, columbium, zirconium, ceramics, and graphite for use under high stress and temperature conditions in missiles that probe higher and higher into space.

Yet Mr. Garrett assured his audience that as the structural problems are solved, and as materials requirements subsequently become better known, we will be able to understand more certainly the nature of the rubber problems that are sure to arise. At the moment, he said, the technicians already know that two rubber problems are paramount—resistance to high temperature and resistance to radiation. For liquid propellant missiles, two other needs are resistance to the extremely low temperatures of liquified gases, and resistance to the corrosive effects of the propellants in contact with rubber.

When we look at the rubber programs of the Services, he continued, we find that these are indeed the areas receiving prime attention. Here, he said, the Quartermaster Corps, which has primary responsibility for the Army's rubber research, is pushing ahead in three main areas: (1) development of fuel and chemical resistant rubbers for use under extreme temperature conditions; (2) determination of the suitability of *cis*-polyisoprene; and (3) development of flame and radiation resistant rubbers.

The Navy and Air Force, he continued, are sponsoring programs of similar scope, though directed toward the specific requirements of aircraft, missile, and vessel application.

On the controversial problem of inter-service competition as it crops up in research and development within the

¹Trade mark, E. I. du Pont de Nemours & Co., Inc.

²Trade mark, Enjay Co., Inc.



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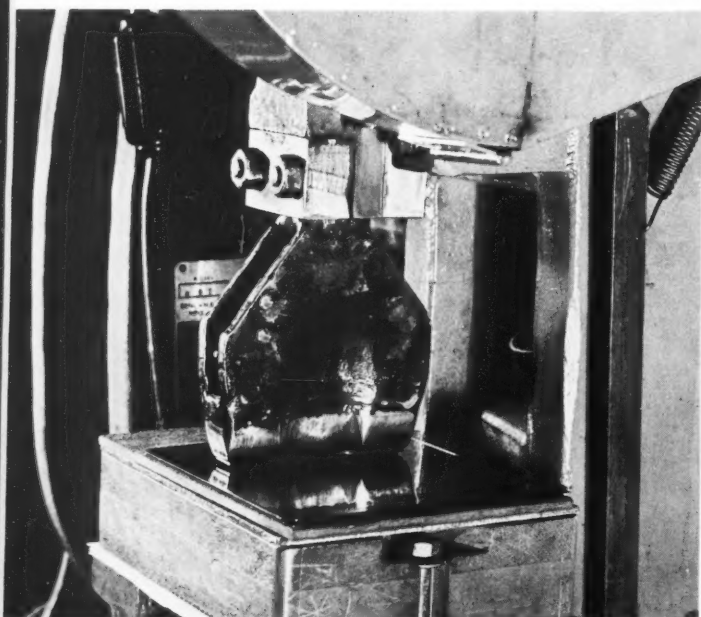
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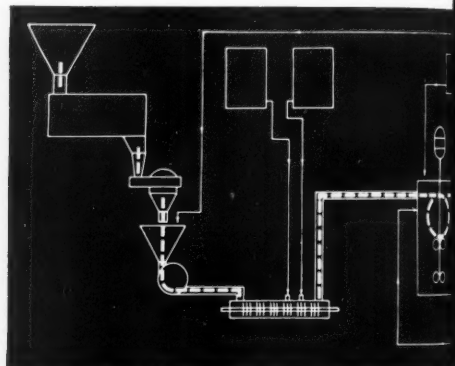
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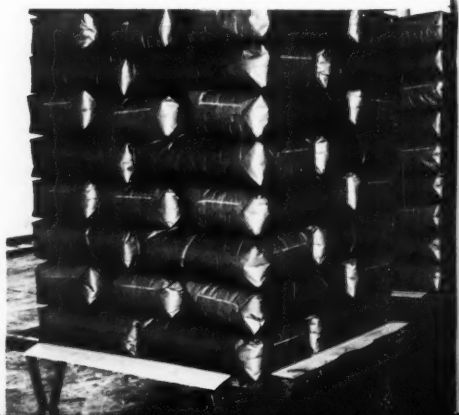


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Defense Department, Mr. Garrett discussed the present organization in which the military branches each have their research arms busily at work while the Office of the Defense Secretary has its own research and development operation trying to coordinate overall activity. One weakness of the present setup, he stated, is the lack of any effective centralized control of funds.

Without this, coordination tends to consist merely of rubber-stamping the plans passed on by the separate Services. To the Services, it looks as if Office of Defense Secretary is attempting to block their efforts toward developing advanced weapons concepts; and to OSD it looks as if all of the Services are trying to develop overlapping and duplicating weapons.

Materials development, consequently, suffers when each Service tends to support an across-the-board program of materials research, he said.

We are now endeavoring to work out with the Services and with our advisors better means of planning long-range materials programs; of financing these programs; and of assuring the best co-operative efforts of the Services in developing the materials needed to retain superiority in weapon performance, he concluded.

At the business session of the meeting a report of the nominating committee was made by Earl Overley, Commerce Department.

The next meeting of the group will be held at Pepco Auditorium on May 21. It will include a panel discussion on "Uses of Polyurethane," with representatives from E. I. du Pont de Nemours & Co., Inc. and Naugatuck Chemical Division of United States Rubber Co., and the annual election of officers.

Huber Patents New Densifier

A new method plus equipment for deaerating and compacting, or densifying, fine powdered materials has been developed and patented by J. M. Huber Corp., Borger, Tex. According to the firm, the densifier makes possible the production of more salable, less dusty products with a uniformly higher density, and affords a positive way of reducing packaging materials and transportation costs. The densifier is designed so that finished density may be readily varied and reliably controlled at any level up to the maximum that can be achieved with the material involved.

According to United States patent No. 2,806,771, assigned to Huber, it has been found that fluffy fine powders can be successfully densified by subjecting them to the action of suction filters similar to those commonly employed for the extraction of liquids from finely di-

vided filterable solids by vacuum. When a finely apertured filtering medium, such as a filter cloth of the type used in ordinary suction filters, is contacted with a fluffy fine powder at one side of the medium while being held under vacuum over its other side, air is drawn through the powder and carries much of the powder along with it toward the filter medium. In this manner a layer of the powder can be rapidly accumulated on the filtering medium, and the suction removes much of the occluded air in the powder and thus compacts it so that a fine powder having a bulk density much greater than that of the original powder can be obtained from the filtering medium.

This characteristic is utilized according to the present invention for the provision of a continuous method of fine powder densification and for achieving a further increase of the density of the powder. Also it has been found that the bulk density of the compacted layer can additionally be increased by mechanically compressing the free side of the layer while continuing to apply suction to the other side.

This equipment has all the advantages of a continuous process, including low power requirements and minimum of operating supervision. The process removes entrained or occluded air from fine, loose powdered materials by the simultaneous application of vacuum filtration and mechanical compression to a regulated and continuously moving product stream. Density control is reliable and simple; vacuum requirements are surprisingly low.

This equipment has been used for tonnage production of materials such as kaolin clays, 75% DDT concentrates, metallic oxides, and silica pigments. In actual commercial practice, the density of these materials has been increased as much as 100-200%.

Manufacture and use will be licensed by Huber to any company interested. The device has already been proved by a number of commercial applications made by Huber and other manufacturers who have taken a license for its use. In addition, Huber has a pilot densifier for processing sample materials for study and evaluation by those interested in the process.

Ontario Group Talk On Urethane Foam

Increased attendance of 123 members and guests of the Ontario Rubber Group met at the Pickfair Restaurant, Mimico, Ont., Canada, on April 8 to hear W. J. Touhey, elastomer chemicals department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., address the meeting on "Resilient Polyether Urethane Foam."

A social gathering, at which Du Pont

was host, preceded the meeting, and at the business meeting, the Group chairman, Wray A. Cline, Canadian General-Tower, introduced the head-table guests, including K. Cunliffe, Dunlop Canada, Ltd., chairman, Division of Rubber Chemistry, CIC.

W. H. Bechtel, chairman of the nominating committee, presented the following slate of officers for the coming year: C. M. Croakman, Columbian Carbon (Canada), chairman; R. R. Taglia, Goodrich of Canada, vice-chairman; D. G. Seymour, Cabot Carbon of Canada, Ltd., secretary; R. Smith, Dominion Rubber tire division, treasurer; L. Lomas, St. Lawrence Chemical, chairman-sports committee; W. Hogg, Naugatuck Chemical, member-at-large; B. Williams, Feather Industries, Ltd., Toronto representative; E. Skarvinko, Firestone Tire & Rubber, Hamilton representative; and C. Fletcher, Dominion Rubber, Kitchener representative.

As there were no further nominations from the floor, the above slate was declared elected unanimously to serve as the 1958-59 executives of the Group.

Mr. Touhey's address described the general chemistry involved in the manufacture of resilient urethane foam, the compounding techniques employed, and the processing variables of temperature metering of ingredients, which is critical, and the mixing.

In the past three years, he reported, the use of resilient urethane foam for furniture and automotive cushioning has increased steadily. Also during this period urethane foams have been introduced into such fields as automotive decorations and safety padding, toys, clothing liners, and many varieties of specialty applications.

The two principal methods of production, continuous slab and individual molding, were described in detail, with numerous excellent slides illustrating the entire address.

Below is a summary of T. H. Newby's address on "The Composition and Activity of Rubber Antioxidants" which was presented before the Ontario Group on March 18 at Guelph, Ont.

Dr. Newby discussed the causes of deterioration of rubber, and the chemistry and function of all commercially important antioxidants. The factors leading to deterioration of rubber were cited as: oxygen, presence of pro-oxidants, heat, ozone, fatigue, sunlight and weathering, and atomic radiation.

He presented a review of the free radical mechanism of oxidation of rubber and showed that very small amounts of antioxidant are sufficient to break the chain reactions. He discussed in some detail the problem of flex cracking in relation to various stocks and the importance of good dispersion of pigments.

Commercial antioxidants were classified as to chemical type and compared on the basis of protection, as well as their staining properties.

WASHINGTON

REPORT

By JOHN F. KING

Cabinet Level Science Coordination, Better Information Service Asked

The recession seems to have checked Congress' headlong dash to "Save Science!" For the most part, the current legislative session has been a race to rescue the economy, first. Moreover, the Army's, and finally, the Navy's success in launching satellites to compete with Russia's Sputniks has taken a lot of the heat off Congress to rejuvenate American science and technology. Yet for all the emergency anti-recession lawmaking, the legislators have not forgotten their New Year resolutions to overhaul federal science functions as insurance against new Soviet surprises in the field.

Committee Investigations

May should see Congress taking the first small steps toward getting back on the science track. The House in mid-April already turned its attention to the U. S. science "lag" in the hearings of the select Committee on Astronautics and Outer Space. Of more direct interest to rubber science and technology, however, are the hearings of the Senate's Government Operations Subcommittee on Federal Reorganization.

Headed by Sen. Hubert H. Humphrey (Dem., Minn.), the Senate subcommittee expects to go into the blind spots of American science growing out of the government's "ineffective" scientific information program. The objective of the study is to reorganize and improve federal activities in the accumulation and dissemination of technical data of use to all the sciences. What is desired is a revamped system of collating, translating, abstracting, indexing, storing, and retrieving technical information now scattered around in some 30 separate components of executive and independent agencies of government, and to coordinate such data collecting with similar activities of other non-governmental sources.

1958 Science and Technology Act

The "data lag" the Subcommittee intends to look into is just one aspect, albeit an important one, of the pending "Science and Technology Act of 1958." Sponsored by Sen. John L. Mc-

Clellan (Dem., Ark.), chairman of the Government Operations Committee, Senator Humphrey and Sen. Ralph Yarborough (Dem., Tex.), the bill (S-3126) would revolutionize federal science functions. It would, to quote its declaration of purpose, "create a Department of Science and Technology; Standing (House and Senate) Committees in the Congress; establish National Institutes of Scientific Research; authorize a program of federal loans and loan insurance for college or university education in the physical or biological sciences, mathematics, or engineering; authorize the establishment of scientific programs outside the United States; and for other purposes."

Government Operations Committee Staff Director Walter L. Reynolds, in an exhaustive analysis of S-3126, declares that the legislation "would establish a focal point through which the scientific agencies of the government would be afforded a medium for the coordination of their efforts into an intelligent and cohesive scientific program."

This "focal point" of science coordination, Mr. Reynolds emphasizes, would repose "at the Cabinet level." Only by having science represented in the top councils of government by a Civilian Secretary of Science and Technology, he states, can it be expected to carry burdens thrust on it by the nuclear age. In specific terms, according to the Reynolds analysis, here is what the bill would provide:

(1) "Urgently needed" coordination of the "scattered activities" of "more than 30 components of executive departments and independent agencies which are engaged in science activities" by the New Department of Science and Technology. The new Department would leave untouched the functions of the President's "personal" staff of advisory and executive bodies such as ODM, Science Advisory Committee, the President's Advisory Committee on Science and Technology, the President's Committee on Scientists and Engineers, the President's Advisory Committee on Government Organization, the Office of Management and Organization (Budget Bureau), the Interdepartmental

Committee on Scientific Research and Development, and the National Committee for Development of Scientists and Engineers.

(2) For the transfer of the National Science Foundation to the new Department, to insure that "comprehensive and objective national programs in the support of basic science are initiated under an official of the government who would have adequate administrative authority and who would be directly accountable to the President and Congress at all levels of operation."

(3) For the transfer to the new Department from the Commerce Department of the National Bureau of Standards, the Office of Technical Services, and the Patent Office. Their activities are being neglected because the Commerce Department "is primarily concerned with carrying on its other functions in economics, business, industry, transportation, and services related to commerce generally." Mr. Reynolds complains throughout his report of the "lack of cooperation" from Commerce officials in the science survey.

(4) For the transfer of the Atomic Energy Commission, the National Advisory Committee on Aeronautics, and "certain functions" of research and development within the Defense Department to the new S & T Department. The programs now run by the military which "belong" in a separate civilian department are activities "relative to the physical and biological sciences which are basic in nature."

(5) For the creation of Standing House and Senate Committees on Science and Technology, "regardless of whether a Department . . . is established." There is, according to a number of scientists polled by Mr. Reynolds, "an urgent need" of science coordination "at the legislative level." Mr. Reynolds and his staff concede that legislative branch reorganization is no easy chore; perhaps it is more difficult than revamping the executive branch's science activities. But he points out that even officials of the executive branch who oppose the new S & T Department idea were "unanimous (the AEC excepted) in indicating an interest in the improvement of the (science) legislative process."

(6) For the establishment of "National Institutes of Scientific Research"—modeled after the Carnegie and

Princeton "basic science" institutes—to promote "pure" science.

(7) For the authorization of educational loans from a fund that by 1965 would total more than \$500 million. The fund build-up would begin with \$40 million for fiscal year 1959, \$60 million in FY 1960, \$80 million in FY 1961, and \$100 million in each of the next four fiscal periods. Financial assistance would be available to qualified students in both basic and applied science and could be dispensed with the cooperation of state agencies, educational associations, and individual institutions.

(8) For overseas programs related to the accumulation and dissemination of science and technology data.

Throughout his analysis, Mr. Reynolds remarks that some scientists interviewed on S-3126 proposals fear both "centralized" science and the "so-called political aspects" of putting civilian science under the control of a "politician" Secretary of Science. The staff director blasts this view as a "complete distrust of our system of government. . . ." He also labels this attitude as a "refusal" by some scientists to "recognize their responsibilities." Regardless of whether some scientists feel the proposal "would contaminate science with politics," Mr. Reynolds declares that the "initiative and responsibility" for going ahead with federal science reorganization rest with Congress itself.

Science Information

With regard to the science information aspect of the bill now being taken up by the Humphrey Subcommittee, the Senators want to know if the elevation of the Commerce Department's Office of Technical Services to the status of "Bureau," and authorizing it to use private collection services, can bring any improvement to the field of assimilating and disseminating scientific information. Provisions of S-3126 would prohibit the Federal Bureau from competing with existing non-governmental facilities; the idea is to "supplement and support" federal activities to further scientific knowledge by employing qualified private agencies.

Backing up the Subcommittee's desire to beef up the Office of Technical Services is the almost unanimous support for such action by leading scientists in and out of the government. The Commerce Department itself, according to Reynolds, is bucking the plan because it "would lose one of its important components."

In reviewing the operations of the present service, Reynolds makes clear he doesn't think it is much of a success; and he quotes some of the country's leading scientists who feel likewise. Mr. Reynolds, and some of his scientific sources, also characterize as "ineffective" and "floundering" the efforts in the information field of the Armed Services Technical Information Agency

and also of the Office of Scientific Information of the National Science Foundation.

In connection with the ineffectiveness to date of the OTS, Mr. Reynolds recites a little recent history. He reports that at a meeting of federal officials last October, it was agreed that the Central Intelligence Agency, the National Science Foundation, the AEC, the Defense Department, the National Institutes of Health "and others" would "turn over to OTS, as a central coordinating agency," all Russian scientific information in government hands. The OTS was to have reproduced and distributed the information and was to have had an addition to its fiscal 1958 budget of \$300,000 to do the job; more money was to be requested from Congress in the pending budget to carry on the work in FY 1959. Both the House and Senate Appropriations Committee turned the project down, how-

ever, "in view of the fact that other federal agencies are already doing some work in this field."

The whole episode, Mr. Reynolds declares, has set the project back at least nine months. According to information reaching his staff, with the above-mentioned \$300,000, some 20,000 abstracts and 5,000 translations would have been available for OTS distribution.

"Recovery of lost ground," Mr. Reynolds tells RUBBER WORLD, "plus the assurance that these people really intend to work together to get this program rolling" is what the Humphrey Subcommittee will be after. He believes the Subcommittee will succeed in forcing some improvement in science information programs because "when you come right down to it, the executive branch also wants a tightening up of the information collection and distribution system."

Commerce Department Approves, But Too Late, Export of Tire Plant Design Data to Russia

On April 7 the Commerce Department issued a press release which stated that the government has "no objection" to the exportation of U. S. technical data for the design of a tire factory being built in Russia by a British combine. In the same breath, the announcement pointed out that "in this particular case" the American applicant for a license to ship the know-how abroad had already lost its chance for a contract with the British group so that "no U. S. technical know-how will be required" after all.

The full story still is not available—the Commerce Department's "background" explanation of the episode doesn't even mention the names of the firms involved. Moreover, the Department's version of the case would appear in contrast with information available from other reliable sources to omit some of the developments that led up to the April 7 announcement. As it can be pieced together from a variety of informants, this is what happened:

British Approach American Firm

Nearly two years ago a consortium of British firms headed by Francis Shaw, Ltd., received the nod of the Soviet Government to construct in Russia a tire plant touted as the second largest in the world. The facility, which the British estimated would cost about \$42 million, would produce two million tires annually and provide for a 15% increase in Russian tire production capacity. In preparing its plans, the Shaw combine solicited an Akron, O., engineering firm, Hale & Kullgren, Inc., to supply the design and layout of the Soviet plant.

Hale & Kullgren accordingly applied to the Commerce Department for a

license to export the required blueprints. The Department refused the license, despite repeated appeals of the applicant, on security grounds. The official position was that the design data "was not generally available" and was "uniquely held in this country." As further explained by Assistant Secretary of Commerce for International Affairs Henry Kearns in the April 7 release:

"The decision was based on the policies and responsibilities of the Department that the Export Control Act should be administered in such manner that the military capability of the USSR can be deterred to the maximum extent."

What Kearns omitted to mention was that his predecessor, H. C. McClellan, had conceded in May 1957, in a letter to Rep. William H. Ayres (Rep., Ohio), who queried the Department on behalf of H & K, that denial of the export license probably would not hurt the Russians. "The British undoubtedly will build the plant," McClellan wrote, regardless of whether H & K participates. While denial of the license might cause the Soviets "considerable delay" in getting the plant into operation, McClellan admitted that the overall "service to United States security" is only "marginal."

McClellan also noted in his May letter to Ayres that European licensees of U. S. rubber and machinery companies could ship not only data to the Soviet bloc which the U. S. as a matter of cold war policy banned, but tires and tire making machinery as well. The export of these goods from U. S. sources also is banned by American export curbs.

But H & K persisted in its efforts to get an export license for the data, despite the fact that the Shaw combine

decided to subcontract the design and layout with Dunlop, the British rubber firm. H & K still wanted the license in the event it could swing a piece of the project under another subcontract either with Dunlop or Shaw. Still the Commerce Department refused the license.

Secretary Weeks Finally Approves

Finally, last December H & K succeeded in going over the head of the Assistant Secretary—then Kearns, McClellan having left the job in the late Summer of 1957. Officials of the firm met with Commerce Secretary Sinclair Weeks. They prevailed on him to check with U. S. rubber goods manufacturers to determine that, as they claimed, the data involved was generally known in Europe and hence freely available to the Russians. Nothing would be gained from continued U. S. refusal to license the export of the know-how except to keep an American firm out of the Russian project, they said.

Weeks took their advice, had the Department check out their assertions, and decided a couple months later that export of the data by H & K would not result in U. S. technology secrets falling into the hands of the Soviets. In a February 24 telegram to the Akron engineering firm, Weeks said he was prepared to "look favorably" on an export license application, if H & K could show that it had a firm contract with the Shaw combine. By this time, so the information of reliable sources has it, H & K had lost even the faintest

prospect of a Dunlop subcontract.

About the same time the Shaw combine and the Soviet Government announced they had firmed up all details of the construction job and entered into a formal contract.

The April 7 "background" explanation of Mr. Kearns said the end of the story went like this: Weeks "recently consulted U. S. rubber manufacturers" and was informed that the know-how for the design of such a plant was now available in several countries outside the U. S. and could be purchased by the Russians elsewhere.

"He therefore decided that continued refusal to permit American firms to participate in the building of this plant would not frustrate the ultimate aim of building the plant. The award of the (design) contract to a British firm (Dunlop) with no requirement for U. S. technical know-how confirms this judgment."

Export Control Act Review?

Following on the Department's April 7 explanation of the tire plant case, Rep. Glen Lipscomb (Rep., Calif.) suggested that "perhaps it is time for Congress to take a new look at our export control policy." Lipscomb, who had been after Commerce for months to get the full story on the H & K go-around, charged that the whole affair produced nothing "to help either American businessmen or safeguard American security." He labeled the Department's explanation of the episode "verbal calisthenics."

Justice Department Consent Decree Ends Goodrich-Dayton Sponge Pact

The Department of Justice hailed The B. F. Goodrich Co. and Dayton Rubber Co. into Federal Court on March 31, charging the two firms with combining and conspiring with the so-called "English Group" to allocate illegally world markets for sponge rubber. The civil complaint of the government charging Goodrich and Dayton with violating Section 1 of the Sherman Antitrust Act was terminated the same day, however, by a consent judgment handed down by the Court.

Pact with "English Group" Ended

The net result of the whole proceedings, according to the Justice Department, is that the sponge rubber manufacturing field "should open up" to prospective new entries.

Under the consent decree formula for settling antitrust cases, defendants agree to cease practices which the government contends are in violation of the Sherman Act, but without admitting that they in fact violated the law.

In its civil complaint Justice charged that Goodrich and Dayton worked il-

legally with the "English Group" to carve up world markets for the manufacture and sale of chemical-process sponge rubber produced under the Talalay foam-freezing method. The Department complaint also alleged that the two rubber companies "conspired to prevent the entry of domestic competitors into the chemical-process sponge rubber market."

The offense, according to the complaint, originally began in 1938. Goodrich, it continued, became a party to the offense only when it entered into the manufacture and sale of sponge rubber in 1954, through the purchase of Sponge Rubber Products Co.

Comprising the "English Group" are two firms and two individuals the complaint named as coconspirators. They are: Joseph Anton Talalay, New Haven, Conn., inventor of the foam-freezing process which made the production of sponge rubber by the Talalay method commercially feasible; Joseph Arthur Howard, London, England, director of Moulded Hair Co., Ltd.; and Hairlock Co., a wholly-owned subsidiary of Moulded Hair, Ltd., which was a registered Delaware corporation until

liquidated in 1943. The Justice complaint alleges that the "English Group" combination is "engaged in the acquisition and licensing of sponge rubber and allied product patents on a world-wide basis," and comments that sponge rubber is widely used as a cushioning material in pillows and mattresses, furniture, auto upholstery, rug and carpet filler and padding, and has other industrial and military uses.

Sponge Field Broadened

Under the consent decree handed down by the U. S. District Court at New York, N. Y., the day the government filed its civil complaint, Goodrich and Dayton are enjoined from allocating world markets, engaging in joint action to prevent domestic competitors from entering the sponge field, or, finally, determining who shall be licensed in the United States to manufacture and sell sponge rubber products under Goodrich-Dayton or "English Group" patents.

Also as part of the consent judgment, Goodrich and Dayton are required "to grant licenses under specified patents to all applicants upon conditions at least as favorable as are contained in any license agreement to any third person."

This last injunction, according to Assistant Attorney General Victor R. Hansen, the government's antitrust chief, "should open up this field of endeavor to other prospective manufacturers of sponge rubber. The resultant effect of new competition will bring to the public the benefits which it has a right to expect in a free enterprise society."

A spokesman for the Goodrich company in Akron said that the company itself had initiated the action to curtail the agreements in line with Justice Department policy.

Louisville Butadiene Plant Mothballed

The day before Publicker Industries' lease on the Louisville alcohol-butadiene plant ran out, the government entered into a stand-by "arrangement" with Publicker, just to keep up house-keeping at the government-owned \$40-million synthetic rubber producing facility.

The so-called "Protection and Maintenance Contract" supplants Publicker's lease, which expired April 4. The new arrangement can be terminated on 30 days' notice and was entered into merely as a stop-gap move "to keep the plant from rusting," according to Federal Corp. spokesmen.

Government officials will not speculate on the ultimate disposition of the Louisville installation, but it is presumed the "Protection and Maintenance Contract" will be observed until such time as FFC can find a responsible

industry willing to buy the plant and take it over.

As explained by government officials before the Publicker lease ran out, there was little expectation of finding a private firm willing to take a flyer, in the middle of a recession, on investment in a major industrial property.

At the same time, the government was not prepared to lose a large hunk of taxpayer investment in the war-born facility by entering into a "distress" sale of the plant. Even though it costs a quarter-million annually to maintain custodial service for the inactive Louisville plant, officials would not care to undertake "giveaway" proceedings.

The month-to-month arrangement signed April 3 with Publicker will permit the government to be in a position to put Louisville on the block when business picks up and industry is in a better position to embark on new expansion.

RMA Opposes S. 11 Bill Amendment in Senate

The Rubber Manufacturers Association, Inc., appeared before the Senate Judiciary Committee on March 15 to register the industry's opposition to S. 11, which would severely limit the right of a seller to meet in "good faith" the lower price of a competitor. It would nullify the "good faith" defense to price discrimination charges under the Robinson-Patman Act.¹

The RMA was particularly concerned with a "compromise" amendment which would limit the applicability of S. 11, the so-called "Kefauver Bill," to the food, drug, cosmetic, and automotive products industries. The amendment was reported to have strong backing in the Committee. "Automotive products" are defined as "all original and replacement equipment, parts, tires, batteries and accessories that may be used in construction, maintenance or repair of automotive power vehicles" and, as such, are of immediate concern to the rubber goods manufacturing industry, it was pointed out.

The above-mentioned amendment is considered by the RMA to be selective and discriminatory.

¹ RUBBER WORLD, Mar., 1958, p. 895; Apr., 1958, p. 119.

Size of Stockpile Still Remains Secret

The Office of Defense Mobilization will continue to hold on to the actual size of the natural rubber stockpile as a state secret, for the time being at least. Defense Mobilizer Gordon Gray's latest word on the subject, disclosed in a letter to Congressional investigators

last month, is that ODM is now "studying" the possibility of declassifying the data.

Mr. Gray's letter ignored assertions by Congressional and rubber industry critics of ODM security restrictions that keeping the rubber stock size a secret is pointless. Anybody who's interested in it, the critics say, can discover with simple arithmetic that there are a million and a quarter long tons in the defense warehouse.

Asked about this by Rep. John E. Moss, chairman of the Special House Subcommittee on Government Information, Mr. Gray would only say that "the disadvantages of declassification have outweighed the advantages. Therefore, no exceptions have been made as yet to the policy that quantitative stockpile goals and inventories shall be classified."

This decision, though based on the advice of all government agencies including the hush-hush Central Intelligence Agency (CIA), does not ignore the recommendation of the Pettibone Stockpile Advisory Committee, which urged in January that more stockpile data be released to the public, the Defense Mobilizer wrote Chairman Moss. That recommendation, he said, "is now

being studied by the ODM and other agencies involved."

The Gray pronouncement dodged the question raised by the Congressman in a February 26 letter to ODM. Why, asked Mr. Moss, does ODM continue to wrap the size of the rubber stockpile in secrecy when it is a "simple matter for anyone to calculate the approximate size of the rubber stockpile at any given time . . ." Quoting the Rubber Manufacturers Association monthly newsletter, "Rubber Highlights," Chairman Moss said the Commerce Department once a month publishes figures on natural rubber imports, consumption and reexports "in such a way as to spotlight a conspicuous stock disappearance during the period of rubber stockpile accumulation." Together with the size of rubber stocks taken over after World War II by the General Services Administration—a publicly available statistic—this formula permits anybody to make the calculations, Mr. Moss said.

Mr. Gray stated only that he has the authority to classify stockpile data, under the provisions of Presidential Executive Order 10501, "Safeguarding Official Information in the Interests of Defense of the United States."

INDUSTRY

NEWS

Du Pont Tire Cord Press Conference Emphasizes Nylon Cord Advantages

E. I. du Pont de Nemours & Co., Inc., textile fibers department, Wilmington, Del., producer of both nylon and rayon tire cord, held an all-day press conference on April 23, at which time research information, test data, and product information were marshalled together to emphasize the superiority of nylon over rayon cord for automobile tires. Du Pont is apparently determined to increase the penetration of nylon cord into the original equipment as well as the replacement market, and the result is an appeal not only to tire manufacturers, but to the ultimate consumer's esthetic sense as well as his appreciation of practical engineering facts.

The conference program consisted of a guided tour of the textile fibers

department's industrial products laboratory and presentation of the following papers relating to nylon tires: "Report on Tire Cord," D. H. Heckert; "Tire Cord Merchandising," J. L. Hayman; and "Nylon Tire Cord—Market History and Future," P. M. Walters. All speakers were from Du Pont's textile fibers department.

J. M. Swanson, in a talk preparatory to a tour of the industrial products laboratory, stated that the overall objective of the laboratory was to assist tire companies in solving various problems associated with the use of nylon in tires. The laboratory is equipped with all the machinery necessary to build, cure, and test experimental tires. Much work is being done on multiple hot-stretching of nylon tire cord, and

both Kidde and Litzler¹ machines are available for this purpose.

On the purely theoretical front, Du Pont is using large-scale computers to develop a mathematical analysis of tire cord strain during the building, curing, and operation of the tire. In addition to the laboratory evaluation of tires, Du Pont maintains two fleets of cars, one in Pennsylvania and one in Texas, for on-the-road service testing of tires.

Report on Tire Cord

Both Du Pont and tire companies' test programs find, D. H. Heckert said, that nylon cord tires are superior to rayon tires in bruise resistance, high-speed performance, flex fatigue resistance, heat resistance, moisture resistance, durability, safety features, and long-range economy, and they are softer riding and cooler running.

All is not "milk and honey," however, and nylon tires do have some deficiencies in the general area of ride performance. Both rayon and nylon tires develop flat spots after standing for a period of time. In the case of nylon the amount of set is greater and persists longer than for rayon tires. Flat-spotting, as such, is of no engineering consequence, but the resultant tire thump during the first few miles of operation could conceivably cause passenger irritation and discomfort. A recent survey, however, by an independent agency, of some 4,000 consumers showed, according to Mr. Heckert, that 99.7% of nylon tire owners find flat-spotting of no concern to them. Substantial improvements in this characteristic have been made through improved nylon and improved processing, and undoubtedly more improvement will follow, Mr. Heckert stated. Other work, furthermore, has shown that the rubber used, the tire design, and the vehicle's own suspension system all contribute to the tire thump problem.

Nylon tires have been reported to run noisier than rayon tires, and this claim has been confirmed by scientific measurement. A comparison of the sound spectra of nylon and rayon tires shows the noise difference to be principally in the low frequency range of 400-800 cycles. On the average and over the entire frequency range the difference in noise level is about five decibels.

The riding characteristics of a vehicle depend on the load-deflection curve of its suspension system—of which tires are an important component. Tests designed to measure the spring-rate of tires show, Mr. Heckert reported, that nylon tires have a 10-15% softer spring rate than do rayon tires. Furthermore, this difference exists under constant operating conditions, and the benefits of nylon increase as the speed increases.

¹ RUBBER WORLD, Feb., 1958, p. 701.

If we focus our attention on the individual tire cord, nylon is again vastly superior to rayon, Mr. Heckert declared. For example, nylon retains 87% of its dry strength when wet, while rayon retains only 55% of its dry strength. At 212 and 300° F., the percentage of strength retained by nylon cord is substantially higher than that of rayon, Mr. Heckert noted.

In simulated service evaluation of the whole tire it is found, Mr. Heckert stated, that the high-speed performance of nylon was about 10% better than rayon, and that at comparable speeds the nylon tires ran about 10 degrees cooler. The bruise resistance of nylon tires is, on the average, about 10 times greater than for rayon tires.

The "proof of the pudding is in the eating," and the practical man's laboratory is his day-to-day car or truck operation. The results of an independent test conducted by a large commercial trucking firm show (see Table 1). Mr. Heckert said, that nylon tires give the lowest cost per mile operation.

TABLE 1. COMMERCIAL FLEET TEST—
NYLON VS. RAYON IN TRUCK TIRES

| | Size 10.3-20 Tube Tires— 33 Months' Service | Nylon Averages (5 Mfrs. Tires) |
|-------------------------------|--|-----------------------------------|
| Total Tires | 167 | 162 |
| Tire Failures | 138 (83%) | 70 (44%) |
| Carcass | 120 (72%) | 46 (29%) |
| All other | 18 | 24 |
| Aver. Mileage (1000 miles) | | |
| Original tread | 66.4 | 77.7 |
| Retread | 60.6 | 60.5 |
| Per tire to date | 170.0 | 217.0 |
| Failed tires | 129.2 | 152.1 |
| Cost/Mile to Date (Mills*) | 1.041 | 0.9204 |

*Calculated by Du Pont, using accepted fleet discount values for new tires and retreads.

Tire Cord Merchandising

Du Pont, according to J. L. Hayman, is expending more effort in advertising and promotion of nylon tire cord this year than in any previous year. This effort is direct to five major categories—the tire dealer, the automobile manufacturer, the new car dealer, truck and fleet operators, and the consuming public.

Although recent studies indicate that 7 out of every 10 tire dealers are of the opinion that nylon cord tires offer the best value to the consumer, Du Pont advertising in this field continues strong and in fact today reaches 147,500 leading tire outlets through appropriate media. During the past year, more than 1/2 million Du Pont sales aids were requested and distributed to retail tire outlets.

As regards to new car sales, the majority of all 1958 makes and models offers nylon cord tires as optional equipment, it was said.

Truck and fleet operators are kept

informed of nylon cord tire progress and performance through advertising in publications reaching a large segment of the commercial trucking industry. The ads feature case histories of large fleets in which cost-performance records show substantial economies through the use of nylon cord tires.

The last major advertising effort is directed toward the consumer through advertisements in nine important general circulation publications having a combined circulation of over 19,500,000 and include a majority of families with income in excess of \$5,000 per year.

Du Pont surveys have shown, Mr. Hayman stated, that as far as tires are concerned, the matter of most concern to a motorist on the road is tire blowout.

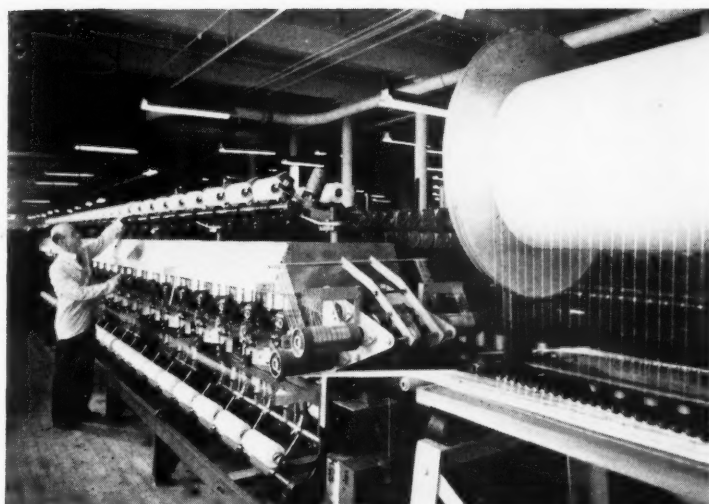
Nylon Tire Cord Plus Market— History and Future

Immediately after World War II, P. M. Walters said, rayon began to replace cotton as tire cord material because of its superior cost-performance record. Shortly after Korea, rayon was able to complete its penetration of the original-equipment market, and nylon tire cord began to make itself known in significant amounts. Starting with the year 1952, nylon usage has increased so that in 1957 approximately 87 million pounds were sold to the rubber industry. A closer look at this period reveals, Mr. Walters said, that rayon reached its peak in 1953 and since then has declined, except for a brief period in 1955. This "second-wind" for rayon was not enough to reach its 1953 peak, however, probably because of nylon's penetration into the market.

When examining production-consumption figures for tires and tire cords, it is important to remember that more rayon is required (on a weight basis) than nylon to make a tire. Therefore when comparing rayon and nylon market statistics, one must compare them on the basis of nylon equivalent to rayon or *vice versa*. When this correction is made, nylon's 87 million pounds for 1957 accounted for about 33% of the tire market.

The approximate position of nylon in last year's tire markets was as follows: airplane, 100%; off-the-road, 100%; truck replacement, heavy-duty, 100%, medium-duty, 30%, light-duty, 10%; passenger replacement, premium, 100%, first line, 30%, second and third line, 20%; original equipment, passenger, 3%, truck, 30%.

In the final analysis, how far nylon goes depends on the customer. Mr. Walters said in conclusion. As the industry continues to capitalize better on its properties and as consumer awareness of its contributions increases, nylon's steady growth in the tire market can be expected to continue, and more nylon tires will be sold.



New Cord Former: single strand packages at top, forming spindles in middle, finished tire cord at bottom, beam supply package in foreground

Automated Nylon or Rayon Cord Producer

A machine that automates production of nylon or rayon cord has been invented by R. J. Clarkson, a United States Rubber Co. textile development engineer. Named the Clarkson Cord Former, the new machine performs in a single operation a cord forming and winding job conventionally done by three separate machines. It also operates at approximately twice the speed of standard tire cord twisting machines and produces a large precision-wound package.

More than a year's experience with the new 48-spindle production machine indicates that it will save 54% in floor space, require 62% less manpower, cut the number of knots in tire cord by 75%, reduce waste by 77%, and lower investment for added capacity by 44%.

U. S. Rubber holds a patent on the new cord former, but is willing to license other firms to use it. The new machine, which will be used primarily for nylon tire cord, makes its appearance at a time when demand for nylon tire cord is increasing. There are 10 times more nylon tires on the road than there were five years ago, and in the past year there has been a 60% increase in their sale in the passenger tire field.

There is a positive growth rate in the use of nylon tires. Since yield per spindle is less on nylon than on rayon, the nation's tire cord producers must either add more spindles or install automated equipment such as the Clarkson Cord Former to meet this growing demand.

U. S. Rubber has plans for the installation of these machines as the need of additional nylon tire cord increases. The first installation will be at the company's textile mill at Shelbyville, Tenn., early in 1959. This installation, for 1,120 spindles, will provide an esti-

mated capacity of 2½ million pounds of tire cord a year.

The machine is supplied by a giant, multiple-end beam, an economical bulk yarn package which helps hold down operating costs. The quality of tire cord it produces is equal to or better than that produced by conventional machines.

The new machine differs basically from conventional tire cord machines by using a wrapping, rather than twisting, operation to form tire cord. It also uses metering rolls to control the flow of the yarn strands being wrapped together so that the finished tire cord is made from yarns of equal length. This condition enables the strands to bear a load evenly.

In the new former, one strand of yarn is put into swirling motion by a disk mounted on a hollow spindle. The disk and the spindle revolve at 8,000 revolutions per minute, causing the yarn, fed through metering rolls from a beam at the end of the machine, to balloon. Within this blurred balloon formed by the rapidly revolving yarn strand is a second package of yarn which is being metered to the junction point of the strands.

The second yarn package is mounted on bearings at the top of the revolving spindle. To prevent this package from revolving, magnets are mounted in the package holder and in fixed mounts just below the revolving disk, thus holding it stationary as the spindle turns. From this second package a yarn strand is fed through metering rolls into the hollow spindle where it is wrapped, with the yarn strand swirling at 8,000 revolutions a minute.

From the spindle the tire cord is precision wound on to packages weighing as much as 40 pounds.

The machine is electrically driven,

using one motor to turn every four spindles. On each spindle the two sets of metering rolls have a common drive to insure uniform yarn length. The machine can be stopped or started from any point along its length by a cable control. It also has tension-stop switches which automatically shut the machine off if a strand breaks.

The limitations of the new machine, now in pilot operation at the Winnsboro, S. C., plant of the company's textile division, are that it can produce only a two-ply tire cord cable, and it can be used only with multi-filament yarn such as nylon or rayon.



Steel cord in Captive-Air inner shield

Captive-Air Safety Tire

The roadside tire change—once one of the principal drawbacks of motoring—is practically eliminated by steel cord armoring of The Goodyear Tire & Rubber Co.'s new Captive-Air Safety Tire. This new development consists of a two-ply layer of steel cord nested between two plies of nylon cord to make up the new tire's protective inner shield, or built-in spare tire.

Result is a tire with two separate air chambers which keeps going for 100 miles or more even if the outer chamber is ruptured and loses its supply of air. The car then rides on the inner tire's reserve air.

Before the steel-wire reinforcing was added, large nails, in extremely rare cases, could work through both the tire tread and the inner shield. With the steel wire shields, ordinary nails are bent over harmlessly before they can pierce the inner chamber, it was reported. Incidence of a disabling flat tire is now less than one in a million tires, or less than one in ten years of driving.

Goodyear's new Captive-Air Safety Tire is being distributed nationwide. Made with 3-T nylon cord, it is available in a full range of 14- and 15-inch sizes, black or white sidewall, tubeless.

Mason Succeeds Bierer

James N. Mason has succeeded John M. Bierer as president and general manager of Boston Woven Hose & Rubber Co. Division of American Biltrite Rubber Co., Inc., Boston, Mass. Mason had been previously associated for eight years with O'Sullivan Rubber Corp., Winchester, Va., and then with Interchemical Corp., New York, N. Y., (1949-1953), where he served as executive vice president of the coated products division of the latter firm.

In February, 1953, Mr. Mason came to Boston Woven Hose to organize and head up its research and development department. In December, 1953, he was elected vice president in charge of manufacturing and development; in October, 1954, he was elected a director, and in June, 1955, executive vice president of Boston Woven Hose. In April, 1957, following the merger of Boston Woven Hose with American Biltrite, Mason was elected a director and the following month a vice president of Biltrite.

Mr. Bierer, who has reached retirement age under the company's retirement plan for salaried employees, has, at the request of the board of directors, agreed to continue as a director and vice president of the American Biltrite Rubber Co., devoting his time and efforts to improving the Rotocure machine and to promoting its sale, which is worldwide.

Following the merger with American Biltrite, Mr. Bierer was elected vice president and director of that company and continued also as president of its Boston Woven Hose division. His contributions to the rubber industry include serving as chairman of the Division of Rubber Chemistry, ACS, chairman of the Goodyear Rubber Centennial Meeting in Boston in September, 1939, and as Fellow of the Institution of the Rubber Industry, England.

With the relinquishing of his duties as president, Mr. Bierer plans to depart shortly on a business trip which will include visits to the company's many Rotocure users and which will take him around the world.



Fabian Bachrach

John M. Bierer



James N. Mason



L. E. Judd

Goodyear's Judd Retires

L. E. Judd, director of public relations for the Goodyear Tire & Rubber Co., Akron, O., for 26 years, has announced his retirement, effective June 1. He was hired by P. W. Litchfield, Goodyear's board chairman, to become the first director of the company's public relations in 1932.

Mr. Judd was a reporter and editor for several Ohio newspapers and was editor of the *Akron Times-Press* from 1925 until 1931. One of the organizers and incorporators of the Public Relations Society in America, he is credited with making important contributions to the development of public relations in

business to the professional level it now enjoys.

Under his direction Goodyear publications have received numerous awards from Freedoms Foundation and other national organizations for outstanding achievement in the fields of employee and human relations.

Judd is a former trustee of the University of Akron; member, Public Relations Society of America, public relations committee of the Citizen's Committee for the Hoover Report, Akron City and Portage Country clubs; and for the past 30 years has been a member of the National Press Club of Washington, D. C.

Nylon Tire Process

A new method of processing nylon passenger tires said to make possible one of the most important improvements in nylon tire quality since the synthetic fiber came into use as a tire cord has been developed by United States Rubber Co., New York, N. Y.

Nylon tires made by the new process, called pressure tempering, will not grow in service and are practically immune to tread-groove cracking, it was reported. The new process also increases the mileage of tires made with nylon cord and gives them more dependable performance at turnpike speeds.

The pressure tempering is being used on the company's entire line of nylon passenger tires, including a new replacement tire.

A nylon tire may increase in height and width by 3-4% during its service life because of nylon's tendency to stretch. This increase is enough to affect the accuracy of an auto's speedometer and mileage indicator. But more important, it may make the tire subject to groove cracking, much as a rubber band will cut more easily under tension than when relaxed.

The pressure tempering process is essentially a method of taking the stretch out of nylon tire cord and rubber compounds. This is done by inflating the tire on a specially designed wheel immediately after the tire has been removed from the vulcanizing mold, while still very hot.

The tire is kept inflated at a high pressure while it continues to cool and cure. During this period the tire is stretched to larger dimensions than the mold. Even in service the tire is never again so large as during the pressure tempering process. Groove cracking is eliminated as a practical consideration, and the tread gives more mileage, better traction, and more skid resistance.

U. S. Rubber engineers said that inflation, while the tire is hot, removes internal stresses, resulting in a tire free of cured-in strains whose parts can work in harmony.

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Continex SRF-NS

WEST LAKE, LA.

Oil Furnace Blacks

Continex HAF
Continex ISAF
Continex CF

SUNRAY, TEXAS

Gas Furnace Blacks

Continex SRF
Continex SRF-NS
Continex HMF

Oil Furnace Blacks

Continex FEF

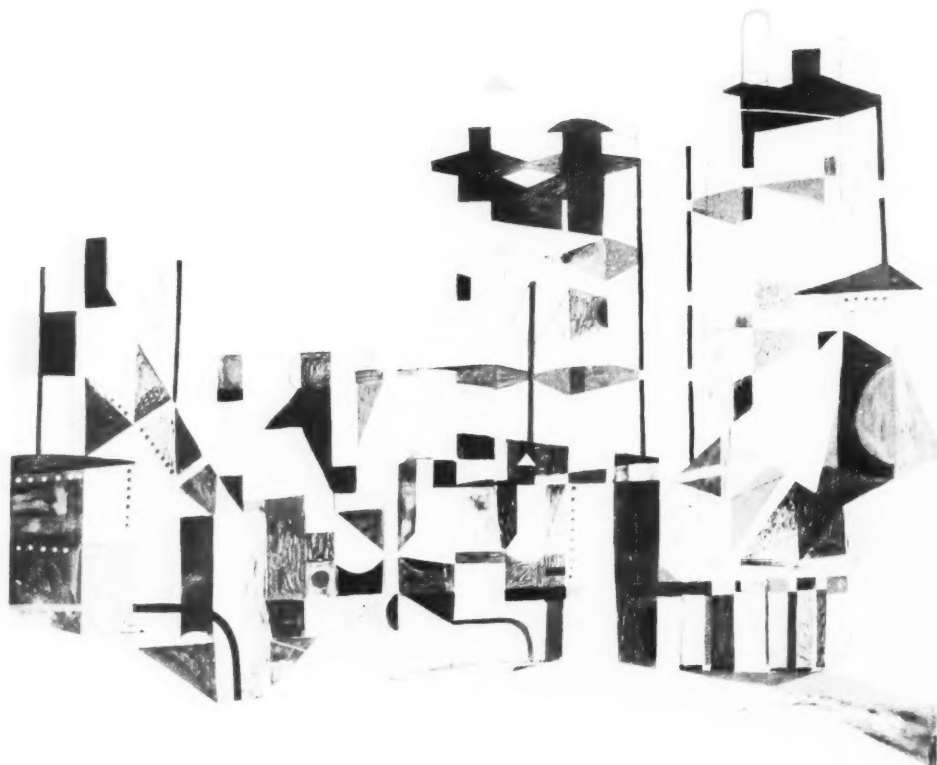
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New Goodyear Resin for Fiber Production

A new polyester resin for use in production of synthetic fibers has been developed and will be produced under the name of Vitel by The Goodyear Tire & Rubber Co., Akron, O. Vitel is an orientable, crystallizable, linear copolyester and is just one of a family of resins from which stem a potentially unlimited variety of products for widespread use. Adaptation of the resin for textile applications represents a unique step in the synthetic fiber industry since production of the resin and production of the fiber will be non-integrated operations.

The resin will be produced by Goodyear in a new \$9-million facility the firm is now building at Apple Grove, W. Va.; while actual spinning will be done by a fiber producer.

A textile giant to which the resin will be supplied is Beunitt Mills, Inc., it was reported. In response to this new Goodyear product, Beunitt has initiated construction of a \$10-million plant for the sole purpose of spinning fiber from Vitel.

The fiber is expected to be used alone or in blends with other fibers and to find usage in underwear, shirts, suitings, dresses, and other related products. It also may be used in non-woven bats, felts, and other bonded structures which take advantage of the high strength and chemical resistance characteristics of polyester synthetics.

Blends of the fiber with other natural or synthetic fibers result in exceptionally strong and durable fabrics. These materials exhibit excellent wash

and wear qualities, resist wrinkling, water, and moths, maintain crease, dry quickly, and will not shrink, it is further claimed.

It is of significance that this development encompasses an entire family of resins. Vitel polyesters are characterized by high strength, exceptional stability, and excellent weather and abrasion resistance. The ability of the Goodyear polyester to yield melts of workable viscosities permits adaptability to many different processing techniques.

One of the products manufactured from a member of this polyester family was introduced in February by Goodyear under the trade name of Videne. A laminating film, Videne A can be adhered under heat and pressure without adhesives to countless end-products. It is intended for direct or stretch laminating applications in the textile, metal, wood, paper, plastics, automotive, and packaging field. Videne Tc, a special wrap for machine packaging of meat and other food products, was introduced at the same time.

The new plant for producing Vitel is expected to be on stream early in 1959 and will then provide polymer for production of fibers for the textile industry, as well as for Videne laminating film. To date, only two applications for Goodyear's polyester have been developed—resins for synthetic fiber and Videne laminating film. The numerous variations possible with the Vitel family promise many other application developments.

New NR-Asphalt Blend for Roads

The Natural Rubber Bureau reports that two scientists in its research laboratory have developed a new process for rubberizing asphalt with natural rubber latex which greatly improves the resulting material for road use. The work is reported in the American Society of Civil Engineers' *Journal of the Highway Division* and is available in reprint form without charge from the Natural Rubber Bureau, 1631 K St., N.W., Washington, D. C. The authors are J. York Welborn, director, and John F. Babashak, Jr., chemist, of the NRB's laboratory.

NRB explains that up to the time of the Welborn-Babashak development, the use of natural rubber in the United States was confined mainly to the addition of dry rubber powder to asphaltic concrete mixtures. Recently, there has been more interest in developing asphaltic materials for use in surface treatment work, and it appeared that rubber in latex form would offer advantages over dry rubber in preblending with asphalt, provided it could meet the following basic requirements:

(1) The latex must be effective in

changing the properties of the asphalt, reflecting this change in improved performance of the binder. (2) It should disperse uniformly throughout the asphalt to produce a homogenous composition that would not separate on storage and application to the road. (3) It should disperse rapidly without resort to excessive temperatures or heating time. (4) The resultant flow properties should in no way interfere with normal construction practice.

It was found that latex alone would not fulfill these requirements so that the addition of vulcanizing agents and accelerators was tried. Sulfur proved to be the best material to use, and the sulfur-natural rubber combination not only markedly improved blending conditions; it greatly bettered overall properties of the rubberized asphalt as well. The quantity of sulfur required was found to be less than 0.3% based on the asphalt.

Data are presented which compare asphalt rubberized with natural rubber latex and sulfur, as well as general synthetic latices. In ductility at low temperatures, and toughness and tenac-

ity, the natural rubber latex-sulfur blends showed outstanding characteristics.

Wire Cloth Slide Rule

Design and production calculations are simplified for processors of metal wire cloth by a multi-scale slide rule prepared by Reynolds Wire Division of National-Standard Co., Dixon, Ill. The calculator gives direct readings of the percentage of open area of any wire cloth with from one mesh to 100 meshes per inch, providing flow rate data required in filtration applications.

Other scales facilitate determination of the following information: lineal feet per 100 square feet and square feet per 100 lineal feet for any wire cloth between 24 and 48 inches wide; weights per 1,000 feet of steel, alloy, and non-ferrous wire from 0.003-inch to 0.120-inch in diameter; and weights of wire cloth for various metals, wire diameters, and meshes, plus shipping costs per 100 square feet of wire for a wide range of freight rates.

Wire cloth fabricators and designers can obtain copies of the calculator by writing to the company.

Dedicates New Labs

Dedication on April 21 of the new Freedlander Research and Development Laboratories at Hawthorne, Calif., marks the latest of a series of expansions by The Dayton Rubber Co., Dayton, O., in plastic foams, adhesives, and foam rubber fields.

The 25,000-square-foot, two-story structure is located at American Latex Products Corp., a wholly-owned subsidiary of Dayton Rubber. These new laboratories will augment research and development facilities at Dayton and Waynesville. N. C. C. M. Christie, president of both Dayton Rubber and American Latex, said.

The new research center was named after A. L. Freedlander, chairman of the board of Dayton Rubber. Freedlander, president of Dayton Rubber from 1936 to 1957, is an authority and pioneer researcher in the development of synthetic rubber.

In addition to expanded research in the fields of foamed and solid state plastics, the laboratory will contain facilities to develop more precise quality control methods, organic analysis, and prototype fabrication. The building houses a complete scientific library, testing facilities, and offices for engineers and technical personnel.

One of the major reasons for locating the research facilities at Hawthorne is because a large amount of aviation and missile work is centered in the area. Both fields offer primary markets for urethanes.

New Plastics Material

The early commercial availability of a new polyethylene-carbon black plastic composition with greatly improved properties has been announced by Hercules Powder Co., Wilmington, Del., and Godfrey L. Cabot, Inc., Boston, Mass.

The two companies said that they have undertaken a joint development program on the chemical cross-linking of polyethylene and carbon black compounds. The results to date indicate the cross-linking procedure will provide industry with a new economical, efficient material for insulating and jacketing wire and cable, forming pipes and tubes, and for compression and transfer-molded products.

Now for the first time compounds loaded with low-cost carbon black and polyethylene will be possible. The key factors which make possible the chemical cross-linking are the development of Di-Cup, Hercules' dicumyl peroxide, and Sterling MT, Cabot's thermal carbon black.

Advantages of the new plastics materials, formed as a result of this cross-linking, include substantially improved strength, improved resistance to heat, and greatly reduced environmental stress cracking. Additional advantages also claimed are exceptionally high resistance to attack by weather, solvents, and surface-active agents. All of these advantages are obtained with practically no sacrifice in the inherently good low-temperature properties of polyethylene.

Results to date indicate that by using Hi-Fax, Hercules' high-density polyethylene, instead of conventional polyethylene, the new plastics materials will have even greater strength and heat resistance, as well as the other advantages gained through chemical cross-linking.

It is expected that the combined background of Cabot's experience with carbon blacks and Hercules' experience with polyethylene will lead to an early commercialization of this new process. Godfrey L. Cabot, Inc., had previously announced the test marketing of CAB-XL,¹ the first polyethylene-carbon black-peroxide compound to be offered.

¹RUBBER WORLD, June, 1957, p. 424.

Goodyear Promotions

Victor Holt, Jr., vice president in charge of sales, was elected to the position of executive vice president of The Goodyear Tire & Rubber Co., on April 8, the position made vacant in January by the retirement of R. S. Wilson.

In addition four new vice presidents were elected for the parent company, as follows: C. C. Gibson, vice president in charge of the automotive products sales division; O. E. Miles, vice president of the replacement trade sales division;



Victor Holt, Jr.

Sam DuPree, vice president of the general products sales group; and M. W. Laibe, vice president in charge of purchasing, general merchandise and material control, traffic, warehousing, and rubber plantations.

Reelected as executive officers were P. W. Litchfield, chairman of the board; E. J. Thomas, president and chief executive officer; P. E. H. Leroy and R. DeYoung, executive vice presidents; H. L. Hyde, vice president and general counsel; and F. T. Magennis, president of Goodyear International Corp.

Other executive officers reelected by the Goodyear board of directors were: R. P. Dinsmore and F. J. Carter, vice presidents; Z. C. Oseland, treasurer; A. E. Firestone, secretary; H. W. Hillman, comptroller; J. F. Bennett and D. H. Walker, assistant treasurers; G. F. Clayton, R. E. Sheldon, and R. L. Miller, assistant secretaries; H. L. Riddle, R. G. Woodling, B. D. Scherer, and J. H. Long, assistant comptrollers.

N. J. Zinc Curtails

The New Jersey Zinc Co., New York, N. Y., has announced that it was closing its mine at Hanover, N. Mex., as of May 1 and also will discontinue roasting operations at its Canon City, Colo., roasting plant on May 15. In addition, substantial cutbacks in production have been announced at the firm's smelting plants at Palmerton, Pa., and Depue, Ill. A company spokesman said that these new curtailments of its operations were made necessary by the continued flooding of domestic markets by foreign zinc.

Unrestricted imports, which reached an all-time high in 1957, not only have created a wholly unrealistic price level for zinc, which has persisted for a year, but have resulted in a heavy surplus of metal on the market at a time when

consumption has been declining. Continued absence of any action by the Tariff Commission or the government to curb imports, the company said, makes it impossible any longer to maintain operations at the two western properties and now forces the company to lay off hundreds of long-service employes at its Pennsylvania and Illinois smelters, many of whom have worked for the company for more than 20 years.

Course at Akron U

The Institute of Rubber Research and the Department of Chemistry of The University of Akron, Akron, O., will again offer this summer a special intensive course on elastomers for scientists and engineers employed in industry and business. The course, "The Chemistry and Physics of Elastomers," will be limited to 25 persons and will be held from June 9-14. Lectures are from 9:00 a.m. until noon and from 6:30 to 8:30 p.m. Laboratory meetings will occupy the afternoons from 1:30 to 4:30 p.m. All meetings will take place in Knight Hall on the University campus.

The topics of the lectures and the lecturers follow:

June 9—"Some Aspects of Tree Rubber," G. Stafford Whitby, University of Akron; "Chemistry of Synthetic Rubbers," Maurice Morton, director of IRR, University of Akron; June 10—"Chemistry of Synthetic Rubbers" (cont'd), Dr. Morton; June 11—"Physical Behavior of Elastomers: Elasticity Theory; Relaxation and Creep," James P. Berry, University of Akron, and Kenneth W. Scott, The Goodyear Tire & Rubber Co.; June 12—"Physical Behavior of Elastomers: Dynamic Properties," Dr. Scott; June 13—"Physical Behavior of Elastomers: Tensile Strength; Reinforcement," Dr. Berry; and June 14—"Chemistry of Vulcanization," Dr. Morton.

The fee for the course is \$150, payable at advance mail registration, which covers all expenses except meals and housing. Further information may be obtained from the director of the course, Dr. Morton.

Satellite Air Tanks

A series of rubber balls, each about the size of a basketball, yet tough enough to contain 269 tons' air pressure, helped trigger the rocket that launched this nation's "Explorer" satellite into orbit. The rubber spheres, reinforced with glass and resin, are part of the pneumatic system for the first stage rocket of the U.S. Army's Jupiter-C. They are made from a new synthetic rubber which forms a virtually impenetrable barrier to air and most

other gases, even under extreme pressures.

Developed by B. F. Goodrich Industrial Products Co., Akron, O., a layer of the new rubber compound less than 1/8-inch thick stops air leakage even at pressures up to 3,000 psi. The new rubber compound operates successfully in a temperature range from minus 65° to 200° F. The rubber balls have survived 65,000 test cycles, from zero pressure to 3,000 psi. and return to zero, without failure. The balls can be designed to deliver any number of pressure cycles, depending on the specifications required.

Manufactured in halves, the rubber hemispheres are shipped to Apex Reinforced Plastics Co., a division of White Sewing Machine Co., Cleveland, O. Apex bonds the halves with a Goodrich adhesive and reinforces the balls by winding them with a continuous cord of epoxy resin-impregnated glass-fiber yarn. The 15-inch spheres are spun on the winding machine until they accumulate a half-inch protective shell of fiber glass, or 39,200 miles of filament for each ball.

Automatic Oil Hose Rig

United States Rubber Co., New York, N. Y., and Asiatic Petroleum Co. have concluded an agreement to build an automatic rig, developed by the rubber company, for conveying oil hose from dockside to ship's manifold.

The rig, based on the operating principle of a pantograph, will be hydraulically operated by one man at a push-button control panel.

Present methods of connecting rubber oil hose frequently require the use of eight- to 10-man crews taking from an hour and a half to two hours for the job. With the new rig, the operator can steer two 12-inch oil hose lines directly to the manifold in three minutes. Thus the rig promises faster turn-around for tankers, whose cost consumption at dock is estimated at \$2,500 per hour. In addition, oil hose life will be greatly increased, because the hose will be protected by the rig itself.

The rig for Asiatic Petroleum is being built by Duncor Associates, Newark, N. J. It is expected to be in operation at the petroleum company's terminal at Bayonne, N. J., by late April.

The rubber company is offering the plans for the unit, known as the Amazon hose rig, to the oil industry generally, without charge. While the rig's cost will vary according to modifications of the basic plan, company engineers estimate its installation at \$40,000. It will weigh 22 tons, not including the two lines of U. S. Amazon wire cord oil suction and discharge hose. It will be 42 feet tall, not including the substructure.

Goodyear to Assist Japanese SBR Plant

Technical assistance in connection with design, construction, start-up, and operation of a general-purpose synthetic rubber plant will be given by The Goodyear Tire & Rubber Co., Akron, O., to the recently established Japan Synthetic Rubber Co., Ltd., Tokyo, under terms of an agreement announced by the U. S. firm.

Ultimate capacity of the plant, which will be the first such facility to go into operation in Japan, will be 45,000 metric tons annually. It will be designed to permit polymerization of synthetic rubber on a continuous basis, to produce latex, hot or cold rubber, and oil-extended rubber.

Plans call for the plant to be erected at Yokkaichi, about 100 miles from Tokyo, near raw material sources of butadiene and styrene, and to be in production by 1960. Approval of the Japanese Government has been granted, and the agreement is effective immediately.

Consumption of synthetic rubber in Japan has shown sharp increases in recent years. The new plant will enable Japan to be virtually self-sustained insofar as this basic raw material is concerned. It also will allow increased usage of synthetic rubber in many products, particularly passenger and light truck tires and retreading materials.

Goodyear has, for a number of years, advocated additional synthetic rubber capacity in leading countries throughout the world. The company stated that this example of exchange of private industry know-how and cooperation between Goodyear and Japan Synthetic Rubber Co. illustrates a type of assistance which affords real foreign aid without cost to our taxpayers.

Cab-O-Sil Available

Godfrey L. Cabot, Inc., Boston, Mass., manufacturer of carbon black and chemicals, has announced that the first American-made Cab-O-Sil is now in production. The chemicals division of Cabot Carbon Co., a subsidiary of Godfrey L. Cabot, Inc., recently completed a plant at Tuscola, Ill., for the production of silicone dioxide and eventually other metallic oxides.

This plant is Cabot's latest advance in supplying American industry's demand for ultra-fine pigments. The plant has an annual capacity of five million pounds of silicon dioxide.

In 1950, Cabot completed a cross-licensing arrangement with Degussa of Germany, in which Cabot obtained the rights to sell and produce the fine silica pigment which the Germans called Aerosil. In 1952, Cabot introduced this product to the American market by importing it from Germany.

In 1953, the trade name Cab-O-Sil was adopted, and a full-scale market development was begun. In 1955, the American demand for the product had increased to the point where production in this country became economical.

A silicon dioxide, essentially pure (99%), Cab-O-Sil is as fine as cigarette smoke. Its present applications include: reinforcing rubber polymers, stabilizing lubricating greases, coating reproduction paper, adjusting viscosity of paints and inks, and controlling properties of a wide variety of industrial powders and liquids.

Polymer Business Good

Polymer Corp., Ltd., Sarnia, Ont., Canada, reported new records in production and sales for 1957 in its annual report made public in April. Although some falling off in Canadian rubber consumption occurred during the second half of 1957, rubber exports continued at a high level, and gross income of Polymer at \$74,615,000 for the year was an increase of 4% over the 1956 figure. Competition was intensified during 1957 by the appearance of additional synthetic rubber from newly expanded United States plants and a decline in the price of natural rubber. Capital expenditures of the company amounted to \$6,598,000 in 1957. Construction was started on a seventh finishing line, and work was completed in early 1958 on a new latex handling plant. An addition to the research and development building is expected to be in use in 1958.

A-C Opens New Offices

Allis-Chalmers Mfg. Co., Milwaukee, Wis., has constructed a new seven-story office building in West Allis directly across the street from the firm's main office. The new building comprises 110,000 square feet of floor space, has a facade of glazed blue brick, glass, and aluminum striping and provides office space for more than 800 employees. First floor of the building is being occupied by the industrial and community relations and the public relations divisions of the company. The second, third, fourth, fifth, and part of the sixth floors house various departments in the comptroller's division. Allis-Chalmers International occupies the entire seventh floor and part of the sixth.

Gro-Cord Rubber Co., Lima, O., has appointed John G. Traver Co., Inc., Philadelphia, Pa., sales representative for Gro-Cord work and safety shoe soles and heels, to cover Pennsylvania, Maryland, and Virginia.

NEWS

BRIEFS

Shell Chemical Co., Torrance, Calif., has announced that its synthetic rubber is now available in the Flotainer. The Flotainer is a strong, lightweight, steel-strapped wooden container reinforced at strategic points to withstand the heavy pressure of settling bales. By controlling cold flow, it prevents bale deformation and film rupture during the critical storage and shipping periods.

The Goodyear Tire & Rubber Co., Akron, O., is producing low-pressure pneumatic tires for military observation aircraft landing and taking off from unusually rough terrain. Army L-19 Bird Dog observation airplanes mounted with either Goodyear Airwheels or 24-inch Terra-Tires are being flown in and out of plowed fields, clearings and other rough ground, ice and snow-covered areas, as well as marshy and sandy regions. The thin, extremely pliable walls of the tires, combined with their low pressure, enable them to absorb or conform with uneven surfaces.

B. F. Goodrich Industrial Products Co., Akron, O., recently sent the largest single shipment of rubber conveyor belting which it has made to the Pacific Coast. Four miles of belt, weighing more than 293,000 pounds and crated in rolls, left Akron recently for use in construction of Trinity Dam in northern California. The belts are designed to haul 20 million tons of rock a distance of two miles from borrow pits to dam site. The system will handle 2,400 tons an hour at a belt speed of 650 feet a minute. The belts will be at work on this project for the next five years.

Precision Rubber Products Corp., Dayton, O., manufacturer of O-rings, Dyna-seals, and rubber-to-metal parts, has opened a new 20,000-square-foot plant at Lebanon, Tenn. All products of the company will be manufactured at the new plant which has been equipped with the most modern machinery. It was reported that the additional facility had been built in order to service the firm's rapidly expanding business. Robert C. Rickey, Jr., formerly superintendent of the Dayton plant, has been appointed general manager of the new facility.

Hooker Electrochemical Co., Niagara Falls, N. Y., and **Shea Chemical Corp.**, New York, N. Y., on April 15 approved a formal agreement for the consolidation of the two companies subject to the approval of the stockholders of each company. Under the terms of the proposed consolidation, Hooker will be the continuing company, and its name will be changed to Hooker Chemical Corp. Shea produces and sells sodium tripolyphosphate, dicalcium phosphate, phosphoric acid, tetra sodium pyrophosphate, ferro-phosphorus and a number of other phosphorus compounds, none of which are included in the phosphorus products produced by Hooker.

General Electric Co., instrument department, West Lynn, Mass., has announced the first butyl-molded potential transformers in ratings through 15 kv. This announcement follows the introduction in December, 1957, of the first butyl-molded transformers for circuits up to five kv. Butyl in the molded construction serves as a combined bushing, case, and insulation. Each model is ionization-free at its rated voltage and has a low, stable insulation power factor.

Beebe Rubber Co., Nashua, N. H., exclusive United States manufacturer of Ripple soles under license from the Ripple Sole Corp., reports a 400% increase in sales of these soles for first quarter of 1958, when 500,000 pairs were shipped, compared with the same period in 1957, when 100,000 pairs were shipped. Total sales in 1957 were reported to be more than a million pairs. The sole ranges in price from 70¢ to \$1.75 a pair at the manufacturer's level.

The Goodyear International Corp.'s aviation products division, Akron, O., has made to order tires, wheels, and single-disk brakes for use on the first jet aircraft to be designed and produced by the postwar Japanese aviation industry. The T1F2 is equipped with 24x7.7, 10-ply tires, wheels and single-disk brakes produced by Goodyear. The company also turned out an 18x5.5, eight-ply tire and nose wheel for the plane. Quantity production of the assembly is anticipated following completion of test flights.

Borden Chemical Co., Peabody, Mass., has announced a new adhesive, Insulgrip, for expanded polystyrene insulation. Developed by the company's coatings and adhesives department, the new product is described as a two-component internal-setting adhesive for the insulation industry designed to bond rigid insulation such as Styrofoam and other types of expanded polystyrene, cork, and rock cork. Insulgrip also is described as an excellent waterproof protective coating and moisture barrier. It is said to possess outstanding properties for use as a calking compound in confined spaces.

Nopco Chemical Co., Harrison, N. J., recommends including a chemical additive, Nopco G, in the coating formulation for easy removal of latex stripped coatings. Because Nopco G lessens the adhesion of protective latex films, they can be stripped easily from goods after transit or storage. Only 0.2% Nopco G, based on formulation solids is required.

Polymer Industries, Inc., Springdale, Conn., producer of industrial adhesives and textile chemicals and intermediates, has been acquired by Philip Morris, Inc., New York, N. Y. Polymer, organized in 1946 by Frank C. Campins, president, a noted chemical engineer, and three associates, is a leader in the field of laminating adhesives. Cofounders of the company with Dr. Campins, all of whom are now Polymer vice presidents, are: Howard L. Kane, a chemist who is in charge of production; Dr. Moses Konigsberg, another chemist, heading research and development; John W. Ogletree, a textile chemist specialist responsible for Polymer's work in the fabrics field; and Raymond T. Clarke, president of Polymer Southern.

Dow Chemical Co., Midland, Mich., has started volume production of methylacetylene-propadiene, a chemical intermediate which is a non-corrosive liquefied petroleum gas. The material, reported by Dow to be available in commercial quantities for the first time, is a mixture of methylacetylene (about 70% by weight) and its isomer, propadiene. Fields in which this material may find use include synthetic rubber, textiles, agricultural herbicides, pharmaceuticals and plastics.

The Firestone Tire & Rubber Co., Akron, O., has distributed gold wrapped tires throughout the United States to symbolize production of the firm's 50,000,000th tubeless safety tire, according to E. B. Hathaway, vice president in charge of trade sales. The Firestone executive announced the special anniversary observance in conjunction with a nation-wide safety campaign being conducted by the Inter-Industry Highway Safety Committee.

Australian Timken Proprietary Ltd., a wholly owned subsidiary of The Timken Roller Bearing Co., Canton, O., expects to have one of its production lines in its new plant operating after June. The plant will produce the first tapered roller bearings to be made in Australia. Forming of the subsidiary was announced by the firm in July, 1957, and construction of the new plant started in September, 1957, in Ballarat, Victoria, Australia. Initial plans called for production capacity of 600,000 bearings a year, but Australian Timken is increasing the capacity by nearly 67%. A recently completed sales survey convinced the subsidiary that the greater production facilities were justified.

The Firestone Tire & Rubber Co., Akron, O., is now producing in the United States tires that can be used on 95% of the foreign autos being operated in this country. These tires are being made in the eight most popular sizes and are available from Firestone dealers and stores throughout the nation. The foreign-car tires manufactured by Firestone in the United States are of the tubeless variety and of the same basic design as tires which are original equipment on automobiles manufactured in this country.

Stillman Rubber Co., Fullerton, Calif., has announced that extruded products compounded from rubber, synthetic rubber, and plastics in standard or custom shapes for a wide variety of industrial and commercial applications are now available from its extruded products division. Extrusions are suitable for use in building construction, aircraft, missile, electronics, boat making, automotive, or general industrial and commercial applications. The extrusions are available in a limitless variety of shapes, sizes, and lengths.

The Electric Storage Battery Co., Exide Industrial Division, Philadelphia, Pa., has announced a planned expansion of its system of regional service stations and warehouses, as part of an overall program to provide customers with improved service on industrial battery products. The new position of supervisor of service stations and warehouses has been created in the division's service engineering department for the purpose of spearheading the national program. Charles L. Eberhardt, Jr., has been appointed to the post. Conversion of former manufacturing depots in Boston and Detroit for use as industrial battery service stations was a first move in the program. Plans call for the addition of service station facilities in other key cities to provide more immediate service and to inventory larger stocks of batteries, battery elements, and related equipment parts at the regional level.

B. F. Goodrich Co. associate dealers in the United States will now service under the domestic Lifetime tire guarantee tires and tubes made by B. F. Goodrich associate companies in Europe for American owners of foreign cars equipped with these tires. The new policy applies to (1) tires which are original equipment on foreign cars imported for sale here, (2) tires imported for sale as replacements, and (3) those brought into the U. S. by tourists from any foreign country.

American Standards Association, New York, N. Y., held a conference on moving sidewalks and the safety problems they incur, March 4. It was agreed unanimously that a safety code under ASA procedures was needed. It was recommended that the work be done by 35-year-old ASA Committee A17 on elevators, dumbwaiters, and escalators. It was also asked that the committee add representatives from other organizations concerned with passenger conveying equipment: Conveyor Equipment Manufacturers Association, National Association of Elevator Contractors, and The Rubber Manufacturers Association, Inc.

Monsanto Oakville, Ltd., Oakville, Canada, producer of a wide range of commercial and industrial vinyls, recently completed a major expansion of modern processing equipment to meet the growing demand for high-quality vinyl products and the increased use by Canadian manufacturers. The new production facilities will be utilized to increase supplies of vinyl film and Monsanto's wide range of fabric-backed vinyls.

Godfrey L. Cabot, Inc., Boston, Mass., carbon black and chemicals manufacturing firm, has appointed Ivan T. Bauman Co., 817 N. Second St., St. Louis, Mo., its agent for the sale of carbon black in the metropolitan St. Louis, eastern Missouri, and southern Illinois areas. The president of the firm is Ivan T. Bauman, who has had considerable experience in selling and warehousing raw materials. His assistant and industrial representative is Edward J. Piel, Jr.

Seiberling Rubber Co., Akron, O., has won a national award for its public service film, "How to Drive on Snow and Ice." The film was voted an Award of Merit in the 1958 safety contest sponsored by the National Committee on Films for Safety, Chicago, Ill. The committee is a cosponsored group of 24 national organizations, including the National Safety Council, the American Automobile Association, the American National Red Cross, and the Motion Picture Association of America.

Allied Chemical & Dye Corp., New York, N. Y., one of the nation's large diversified chemical companies doing business since 1920, is about to become simply Allied Chemical Corp. in order to have a name that will reflect the broad nature of the company's position in the chemical industry and which will not single out a particular division or field of activity.

The General Tire & Rubber Co., Akron, O., has made an unprecedented agreement to pay for road service in case of a puncture of the Dual 90 automobile tire. This is the first time American motorists have received such an offer. In the event of a puncture, the Dual 90 owner should contact the nearest General Tire dealer. His service agreement provides for free road service to dismount the damaged tire and mount the spare, should the tire be punctured in the tread area by a foreign object during the life of the original tread.

The Goodyear Tire & Rubber Co.'s Pliolite S6B, a rubber reinforcing resin, currently is serving an important function in the soles of a complete line of casual shoes designed for women, junior misses, and girls by LaCrosse Rubber Mills Co., LaCrosse, Wis. Soles for this type of play shoe must present a pleasing appearance, yet be lightweight and have high abrasion resistance and necessary stiffness.

Military Clothing & Textile Supply Agency, Philadelphia Quartermaster Depot, U. S. army, has made an award to Toyad Corp., Latrobe, Pa., covering mattress, bed, foam rubber, w/tick cover. This procurement, for the U. S. Navy, totals 1,265, at a price range from \$48.90 to \$65.32 each for a total dollar value of \$79,920.95.

Iowa Paint Mfg. Co., Inc., Des Moines, Iowa, has introduced to consumer markets HydroPool, a water, alkali, and chemical resistant paint developed for swimming pool use. Based on Pliolite S-5, a synthetic rubber resin produced by the chemical division of The Goodyear Tire & Rubber Co., the new paint is said to excel as an under-water coating and will not blister, peel, or flake away from correctly prepared surfaces.

B. F. Goodrich Chemical Co.'s highest safety award, the President's Cup, has been won by the company's Avon Lake, O., general chemicals plant. The award is given each year to the plant with the lowest injury frequency rate among the seven plants of the chemical company. John R. Hoover, BFG Chemical president, in recent ceremonies presented the Cup to Perry Hayes, a chemical operator.

News Briefs

United States Rubber Co., New York, N. Y., has developed a lightweight cover, called Fiberthin, for covering jet engines while in shipment. Conventional delivery of the jet engines calls for use of heavy container-type cans and rail shipment. The new use of Fiberthin, special shipping buck and aircargo affords substantial savings in time and costs, according to its users.

Lord Mfg. Co., Erie, Pa., has found that its Chemlok 605 is an excellent adhesive for bonding the new Du Pont fluorocarbon elastomer, Viton A, to steel, copper, brass, aluminum, titanium, magnesium, chrome-plated steel, and other substrates. Evaluation tests measured the bond strength of Chemlok 605 with Viton A at temperatures ranging as high as 500° F. and found it in excess of the strength of the stock.

The Goodyear Tire & Rubber Co. of Canada, Ltd., recently sold its warehouse and office building at Fleet and Bathurst Sts., Toronto, Ont., to Molson's Brewery (Ontario), Ltd. Carter Construction Co., Ltd., has been awarded a contract to build a \$2,500,000 warehouse and office building, consisting of a one-story warehouse with a second-story office section for Goodyear. The warehouse will cover 375,000 square feet, on 18th St. in New Toronto.

The General Tire & Rubber Co., Akron, O., has announced that it will rush to completion its \$3¼-million network of giant tire retread plants designed specifically for the Federal Aid Highway Program, following President Eisenhower's signing of legislation authorizing a \$1.8-billion increase in federal spending on highway construction this year.

The Firestone Tire & Rubber Co., Akron, O., was a recipient of the National Safety Council's 1957 Public Interest Award. The company's advertising campaign was cited as an exceptional service to safety. Firestone promoted traffic safety on its nationwide TV program, "The Voice of Firestone," saluted the National Safety Congress and the annual meeting of the Institute of Traffic Engineers, and publicized traffic safety in newspapers and magazines.

The B. F. Goodrich Co., Akron, O., has been awarded a United States Department of Defense Award presented to John L. Collyer, chairman of the board, and J. Ward Keener, president, by General O. P. Weyland, Commander of the Tactical Air Command. The award, a citation and pennant, recognizes the company for its outstanding cooperation with reservists and Reserve activities.

Wilson & Geo. Meyer & Co. and its affiliate, **Wilson Meyer Co.**, sales representative for Eastman Chemical Products, Inc., in the Pacific Coast regions of the United States and Canada, dedicated their new, enlarged Southern California offices, warehouse, and bulk storage facility at 2060 S. Garfield Ave., Los Angeles, Calif., early in April. The Meyer firm serves the West Coast plastics industry in the distribution of the Eastman line of Tenite plastics—acetate, butyrate, and polyethylene. They also distribute Eastman plasticizers, solvents, antiozonants, antioxidants, and basic chemical raw materials to such diversified industries as feed, rubber, food, protective coatings, petroleum, and pesticides.

Dunlop Canada, Ltd., Toronto, Ont., has the unique distinction in the North American rubber industry of having sponsored a hockey team known as the "Whitby Dunlops," which on March 9 won the world's hockey championship by defeating Russia, 4-2, in Norway. The team has only been in existence for a few years, but has won championship after championship and in the recent series successfully defeated not only Russia but the United States, Sweden, Finland, Norway, Czechoslovakia, and Poland.

The Goodyear Tire & Rubber Co., Akron, O., has appointed Bate Chemical Corp., Ltd., Toronto, Ont., Canada, distributor of Pliolite resins. With sales and warehousing facilities in both Toronto and Montreal. Bate will provide sales and technical service to paint and coating accounts for Pliolite S-3, S-5, S-7, and VT solution resins and natural rubber Pliolite.

Military Clothing & Textile Supply Agency, Philadelphia Quartermaster Depot, U. S. Army, Philadelphia, Pa., has made an award on bid QM 36-243-58-581, covering mattress, bed, foam rubber padding, 72½ by 26 by 3 inches and 76 by 34¾ by 6 inches to The Firestone Tire & Rubber Co., Akron, O. The bid was for 11,632 mattresses, at \$32.26-76.30 each, for a dollar value of \$407,645.90. The procurement is for the U.S. Navy.

Stillman Rubber Co., Fullerton, Calif., has developed a special weather-resistant line of extrusions for windshield weather-stripping and gunwale bumpers for boat manufacturers and owners. Available in a complete line of extrusions to boatmakers requirements, the extrusions come in standard or special shapes.

NEWS

about PEOPLE

Theodore M. Vial has been appointed manager of technical service of the rubber chemicals department, organic chemicals division, American Cyanamid Co., Bound Brook, N. J. Dr. Vial since 1954 has held supervisory positions in the new product development department of the company.

G. G. Beard, K. C. Gardner, Jr., Wm. K. Frank, Neal J. Crain, and **Charles F. Safreed** have been elected directors of United Engineering & Foundry Co., Pittsburgh, Pa. Mr. Crain, vice president and director of purchases, is a new director and was elected to fill a vacancy created by the retirement of **Harry M. Naugle**. Mr. Crain has served the company in various capacities for the past 45 years. Also, all the present officers were reelected by the directors.

Harold B. Wright has been named to the new post of Royalite commercial products sales manager at the Chicago, Ill., plant of United States Rubber Co. Wright, who joined the rubber company's footwear and general products division in 1951, will head a force charged with the sale of sheet stock and molded parts to industrial customers. Royalite is a blend of synthetic rubber and thermoplastic resins which is formed into sheets and molded into various shapes. It is a tough, lightweight material that comes in a variety of colors.

Roy Simpson has been named national manager of off-the-road tire sales for The General Tire & Rubber Co., Akron, O. He was formerly Southeast regional manager of off-the-road sales, with headquarters in Atlanta, Ga.



Mel Sutter Studio

Don R. Kuespert

Don R. Kuespert has been assigned to a sales development territory centering around Akron, O., for the elastomer chemicals department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. He will work closely with Du Pont rubber customers in evaluating new materials to determine commercial utility and will assist in planning and executing field testing programs, market research activities, and test selling.

Fred J. Holzapfel has been named director of engineering for Monsanto Chemical Co.'s organic chemicals division, St. Louis, Mo. Associate director of engineering for the division since December, 1957, Holzapfel succeeds **Proctor H. Avon**, who is transferring to the firm's plastics division at Springfield, Mass.

Nicholas W. Tozza has been appointed a technical service specialist for the Claremont Pigment Dispersion Corp., Roslyn Heights, Long Island, N. Y. His experience and intimate knowledge of flexographic and gravure printing will enable him to render excellent service to printers in the New York Metropolitan Area.

Walter A. Sheehan has been appointed sales manager of the fire hose division of the Boston Woven Hose & Rubber Co., Division of American Bilt-rite Rubber Co., Boston, Mass. In this new position he will direct the company's industrial and municipal sales activities for its complete line of fire hose.

Arthur M. Pounds has been appointed supervisor of new product development at the B. F. Goodrich Chemical Co. Development Center at Avon Lake, O. He has been with the company since July, 1948.

J. E. Burrell has been made general manager of operations for Columbia-Southern Chemical Corp., Pittsburgh, Pa. He succeeds the late **Robert L. Hutchison**, who served as vice president in charge of operations. Prior to his appointment as general manager of operations, Burrell served as assistant to the vice president in charge of operations.

J. H. Ruskin has been elected president and director of the Arizona Chemical Co., New York, N. Y. The firm, jointly owned by International Paper Co. and American Cyanamid Co., is a principal producer of tall oil and tall oil products which go into the manufacturing processes of a wide variety of industries.

James M. Gavin, former Army Chief of Research and Development, has been elected vice president and a director of Arthur D. Little, Inc. General Gavin will assume his duties as an administrative officer of the company on June 1 at Acorn Park, the ADL research center in West Cambridge, Mass.

W. A. Weber has been appointed manager of plant services, and **Stuart Whitehead** manager of the rubber chemicals manufacturing department of the Bound Brook, N. J., plant, organic chemicals division, American Cyanamid Co., New York, N. Y.

Wilber C. Nordstrom has been elected vice president-manufacturing, The Standard Products Co., Cleveland, O. With the firm since 1950, he has served successively as manager of the West Coast division, manager of the Reid division at Cleveland, manager of manufacturing, and general manager of manufacturing.



Wilber C. Nordstrom

Henri V. Krakowski and **Gene L. Unterzuber**, rubber technologists, have been appointed to the laboratory staff of the Oliver Tire & Rubber Co., Oakland, Calif. Principal products of the company are tire tread rubber, automotive rubber assembly parts, and rubber components for industry.

Richard V. Thomas, former assistant to R. DeYoung, Goodyear executive vice president of production, has been named director of international manufacturing and vice president of the Goodyear International Corp., Akron, O. **R. A. Jay**, manager of the engineering department, has been named assistant to the president. He is succeeded as head of the engineering department by **J. D. Petersen**, since 1957 manager of electrical engineering.



Richard V. Thomas

James A. Napier has been named director of allied sales sections of the tire division, United States Rubber Co., New York, N. Y. He will be responsible for the following tire sales divisions: Fisk, Gillette, bicycle, aircraft, and bus mileage. This position is a new one. Napier was formerly assistant sales manager for the U. S. Tires division.

Louis C. Pape has been named general sales manager for The Dayton Rubber Co.'s foam division, Dayton, O. He will direct sales for the company's entire line of foam products, both latex and flexible plastic. Principal markets for both types of foams are in the furniture, cushioning, and apparel industries. His headquarters will be in the foam division's general sales offices in Asheville, N. C.

Robert V. Cleary, control manager, United States Rubber Co., Mishawaka, Ind., has been elected to membership in the Controllers Institute of America.

Leland M. White has been named director of research and development for United States Rubber Co., New York, N. Y., replacing **Sidney M. Cadwell**, who has retired after 39 years of service. Dr. White, joining the company in 1940, rose to research group leader, then department head, and since 1953 has been assistant director of the department. During his career he developed a process for making specialty types of synthetic rubber now used by the wire and cable industry. He has also done basic research on cold synthetic rubber, carbon black masterbatches, and easy-processing synthetic rubbers.

Albert E. Myers has been named head of the plasticizers and extending oils section of the industrial products department, Shell Oil Co., New York, N. Y. He will coordinate research, development, application, and marketing of Shell's Dutex products line for the rubber and plastics industries. Dr. Myers succeeds **W. Wayne Albright**, who has been promoted to the industrial products management staff in Shell's New York marketing division.

Joseph Regenstein, Jr., president of Velsicol Chemical Corp., Chicago, Ill., has been made chairman of the board of directors; while **E. T. Collinsworth, Jr.**, executive vice president, has been named president. **John F. Kirk**, vice president and director of sales, was appointed to the board of directors.

R. G. Lusk now is West Coast district manager for the chemical division of the Goodyear Tire & Rubber Co., Akron, O. With headquarters in Los Angeles, he will be directly responsible for all sales and technical service activities emanating from the chemical division's Los Angeles, San Francisco, and Portland offices. Prior to this latest assignment Lusk had been special representative servicing accounts in the Southwest. The Goodyear chemical division, with 15 sales offices throughout the country, markets high polymer resins, rubber, and latices to the rubber, plastics, paint, paper, and textile industries.

Robert P. Kenney has been named director of international activities for B. F. Goodrich Chemical Co., Cleveland, O. He will be responsible for coordinating company activities dealing with foreign associate companies, international sales, and foreign licensing.

Edward P. Loftus has joined Marbon Chemical, Gary, Ind., a division of Borg-Warner Corp., as a technical sales representative. He will cover the states of Missouri, Kansas, Oklahoma, Nebraska, Colorado and Texas.



Pach Bros.

Leland M. White



Albert E. Myers



Edward P. Loftus

F. J. Seider has been made manager of general services, sales department, Union Carbide Chemicals Co., division of Union Carbide Corp., New York, N. Y. He will retain overall supervision of the general sales office and will act as the clearing house for agent and reseller affairs as they apply to the New York office. **J. N. Falkinburg** becomes manager, general sales office, replacing Seider. Also he will have general supervision of the contract department. **J. M. Sartorius** and **J. P. Galaba** have been appointed assistant managers, general sales office.

J. H. Langstaff has been named products sales manager for general chemicals, Monsanto Canada, Ltd., Montreal, P.Q., Canada. **J. K. McCabe** has joined the plastics and resins sales department of the company as a technical sales representative. Langstaff's new position has been created by the continuing expansion and development of the general chemicals department's sales activities.

Donald E. Cornmesser has been appointed plant manager of the Rubatex division, Great American Industries, Inc., Bedford, Va. He was formerly works manager for Bridgeport Rubber Co., division of H. O. Canfield Co., Bridgeport, Conn. Prior to that, he had been superintendent of the rubber division of The Thermoid Co., Trenton, N. J., and plant manager of DeVilbiss Co., Toledo, O.

Edward M. Bader, manager of quality control for B. F. Goodrich Aviation Products for the past 14 months, has been named division manager of quality control for B. F. Goodrich Tire Co., Akron, O., replacing **Leonard M. Freeman**, retired. Bader is chairman of the quality control subcommittee of Committee D-11 on Rubber of the American Society for Testing Materials.

Harvey Lieberman has been made manager of technical service, organic peroxide catalyst division, Nuodex Products Co., division of Heyden Newport Chemical Corp., New York, N. Y. **Raymond J. Schraff** has been named manager of the new division's Cleveland branch office, 815 Superior Ave., Cleveland, O.

William N. Cargile has been made general sales manager of the American Latex Corp., Hawthorne, Calif. He was formerly branch manager for American Latex in San Francisco.

John C. Henderson has been appointed general merchandising manager, and **Fred P. Shand**, general sales manager of Gutta Percha & Rubber, Ltd., Toronto, Ont., Canada.

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Wherever you do business Polymer can bring you the help of one of the world's most comprehensive sources of commercial and technical rubber experiences.

Polymer representatives are daily bringing this experience to bear on the needs of rubber users the world around. In modern laboratories at Sarnia technicians are always working on applications and new compounding techniques. A continuing flow of technical literature goes out from Polymer to rubber compounders throughout the world.

Polymer service—unparalleled in the rubber industry—brings a whole world of experience to your door.

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News about People

George M. Sprowls has been appointed director of research of American Rayon Institute, Inc., New York, N. Y. Until February, 1957, he had been manager of the highway transportation division of the Goodyear Tire & Rubber Co., Akron, O., with which he had been associated for 45 years. He will make his headquarters in Akron.

Edward J. Mackey has been appointed to the post of manager, management engineering, at The Goodyear Tire & Rubber Co., Akron, O. Assigned to the president's office since 1945, Mackey succeeds **George Sherry**, who retired on March 31. As manager of management engineering, Mackey will be responsible to the president for special assignments in Goodyear's domestic and international operations.

Mayer Silbert has been made sales manager of the chain-store division of the sales department of The Mansfield Tire & Rubber Co., Mansfield, O. **Roger D. Steinebrey** has been appointed to a special assignment in TBA sales development with oil companies; while **J. H. Buckalew** has been named sales manager of related products in the sales department.

F. W. Kayser has been appointed merchandise manager of the industrial products divisions of Hewitt-Robins, Inc., it was announced by F. L. Griffith, vice president and general sales manager. Mr. Kayser will be headquartered in Stamford, Conn., and will be responsible for the administration of merchandise sales policy.

William B. Carter has joined Columbian Carbon International, Inc., New York, N. Y., as staff assistant to the vice president. He comes to Columbian with important experience in foreign operations in both Europe and Latin America. He was formerly with Dewey & Almy Chemical Co. Division of W. R. Grace & Co. and Godfrey L. Cabot, Inc. Columbian Carbon International represents Columbian Carbon Co. in the international sale of its carbon blacks and iron oxide pigments and it also represents abroad other producers of raw materials for industry.

John H. McKenzie, of New York, has been named director of research and development for United Carbon Co., Charleston, W. Va. Formerly assistant to the general manager of research and development of American Can Co., for the past five years he was chairman of that company's research committee. He has had 21 years' experience in the research field. United Carbon is a leading manufacturer of carbon black and synthetic rubber and an important producer of natural gas and crude oil.



George M. Sprowls



William B. Carter



John H. McKenzie

John K. Rudd becomes manager, custom products division; **William R. Runo**, manager, standard products division; and **Samuel M. Dix**, manager, resale products division, for Richardson Scale Co., Clifton, N. J. Rudd will be responsible for the application of Richardson equipment to new or special customer requests. Runo will direct the promotion and coordination of standard product lines. Dix heads the division through which accessories such as gates, sewing machines, and conveyors are selected as components of Richardson systems.

John L. Gillis and **T. M. Martin** have been elected to the executive committee of Monsanto Chemical Co., St. Louis, Mo. The board of directors also elected **Irving C. Smith** a vice president, **H. Harold Bible** a vice president of the company and general manager of the Lion Oil division, and **E. J. Cunningham** controller of the company and director of Monsanto's accounting department.

Theodore M. Vial has been appointed manager of technical service of the rubber chemicals department, organic chemicals division, American Cyanamid Co., Bound Brook, N. J.

A. C. Hamstead and **H. M. Rife** have been appointed staff associates, and **L. S. VanDelinder** group leader in the development department of Union Carbide Chemicals Co., division of Union Carbide Corp., South Charleston, W. Va.

J. Terry Taylor, manager of fuel cell operations in B. F. Goodrich Aviation Products, has been appointed manager of product service and field engineering for B. F. Goodrich Tire Co., with headquarters in Akron, O. He was stationed in Los Angeles, Calif., for the past two years.

Wilbur B. Pings has been appointed general manager of the varied chemical lines of Kessler Chemical Co., Philadelphia, Pa.

Frank E. Taylor, Jr., quality control supervisor of Oliver Tire Rubber Co., Oakland, Calif., has been elected president of the American Institute of Industrial Engineers, San Francisco-Oakland Chapter.

George Sherry, manager of management engineering for the Goodyear Tire & Rubber Co., Akron, O., and a member of the staff of Goodyear President E. J. Thomas, retired at the end of March, completing 39 years of service with the company, which he had joined in 1919 as an auditor.



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4-5300
Pelham Manor 65
Pelham 8-3040
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Granite 2-0296

OHIO

Akron 10
Blackstone 3-7733
Cincinnati 4
Wabash 1-5500
Cleveland 5
Vulcan 3-6100
Columbus 4
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Vanport
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Brownsville
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Exeter
Olympic 4-6795
Greensburg
Greensburg 5600
Harrisburg
Cedar 4-0115
Johnstown
Johnstown 33-2111
Marcus Hook
Chester 5-1184
Philadelphia 3
Kingsley 6-1600
Pittsburgh 38
Sterling 1-1252
Reading
Franklin 6-7464
Williamsport
Williamsport 8-8661

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Providence 5
Hopkins 1-8100

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Terminal 3-1421
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John McGavack

John McGavack, technical director of the plantations division, United States Rubber Co., retired on February 28. Dr. McGavack is particularly well known for his work in the natural rubber latex field, and a number of U. S. patents have been issued in his name. He also worked on the development of rubber derivatives, including rubber chloride and hydrochloride. He served for many years as chairman of the bibliography committee of the Division of Rubber Chemistry of the American Chemical Society and has indicated his intention of continuing with this bibliography work which provides for the Rubber Division's periodic publication of successive volumes of "Bibliography of Rubber Literature."

Walter J. Beadle, after 30 years with E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., retired May 1 as a vice president and member of the executive committee. **George E. Holbrook**, general manager of the elastomer chemicals department, became a vice president, director, and member of the executive committee on May 1, and **Charles B. McCoy**, assistant general manager of the electrochemicals department, was made general manager of the elastomer chemicals department. Since Beadle will remain as a director of the company, the membership of the board of directors was increased to 32. Also the board re-elected **Walter S. Carpenter, Jr.**, chairman of the board, **Crawford H. Greenewalt**, president of the company, and all other principal officers.

David T. Mowry has been appointed director of development for the research and engineering division, Monsanto Chemical Co., St. Louis, Mo. He succeeds **John J. Healy, Jr.**, now a member of the company's newly formed planning staff.

John Dersch has been promoted to general production manager of the Borden Chemical Co.'s coatings and adhesives department. He will headquarter in the department's offices at Peabody, Mass.

Gordon Lawrence has been appointed sales and technical service representative, Quebec area, for The Pigment & Chemical Co., Ltd., Montreal, P.Q., Canada, with headquarters at the main office on Decarie Boulevard in Montreal. He was previously with the Dominion Rubber latex and reclaim division.

Robert C. Bodine, partner in the brokerage firm of De Haven & Townsend, Crouter & Bodine; **J. Paul Crawford, Jr.**, vice president of New York Trust Co.; and **Winfield A. McGill**, partner in C. A. McGill & Sons, New Hope, Pa., have been elected to the board of directors of the Goodall Rubber Co., Trenton, N. J.

Marcy W. Osborne, Jr., has been appointed to the newly created position of manager of propellant materials for B. F. Goodrich Chemical Co., Cleveland, O. He will be in charge of all BFG Chemical activities relating to propellant binders and fuels used in missiles and rockets. He will report to John R. Hoover, president of the company.

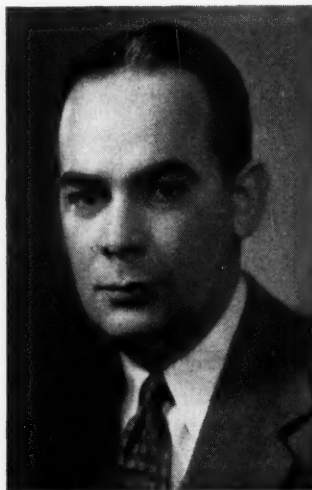
Harry M. Dent, Jr., has been appointed a district sales manager for the Durez Plastics Division of Hooker Electrochemical Co., North Tonawanda, N. Y. He will be located at the home office, and his territory will include New York State, except for New York City and the Hudson River area, and will also include western Pennsylvania, Ontario, and Quebec.



Harry M. Dent, Jr.

Harry L. Fisher, who recently was retired as director of the Tlurgi Rubber Technology Foundation, is now vice president in charge of research and development of Ocean Minerals, Inc., Los Angeles, Calif. The company is using a method for removing minerals, except sodium chloride, from ocean water in a chelated form for use as fertilizer and for animal feeds, and Dr. Fisher is working on a means of obtaining fresh water from the salt water effluent.

Edward A. Taylor is now plant manager of the new West Elizabeth plant of Pennsylvania Industrial Chemical Corp., Clairton, Pa. The plant, placed on stream in February, 1958, will produce hydrocarbon resins and aromatic solvents.

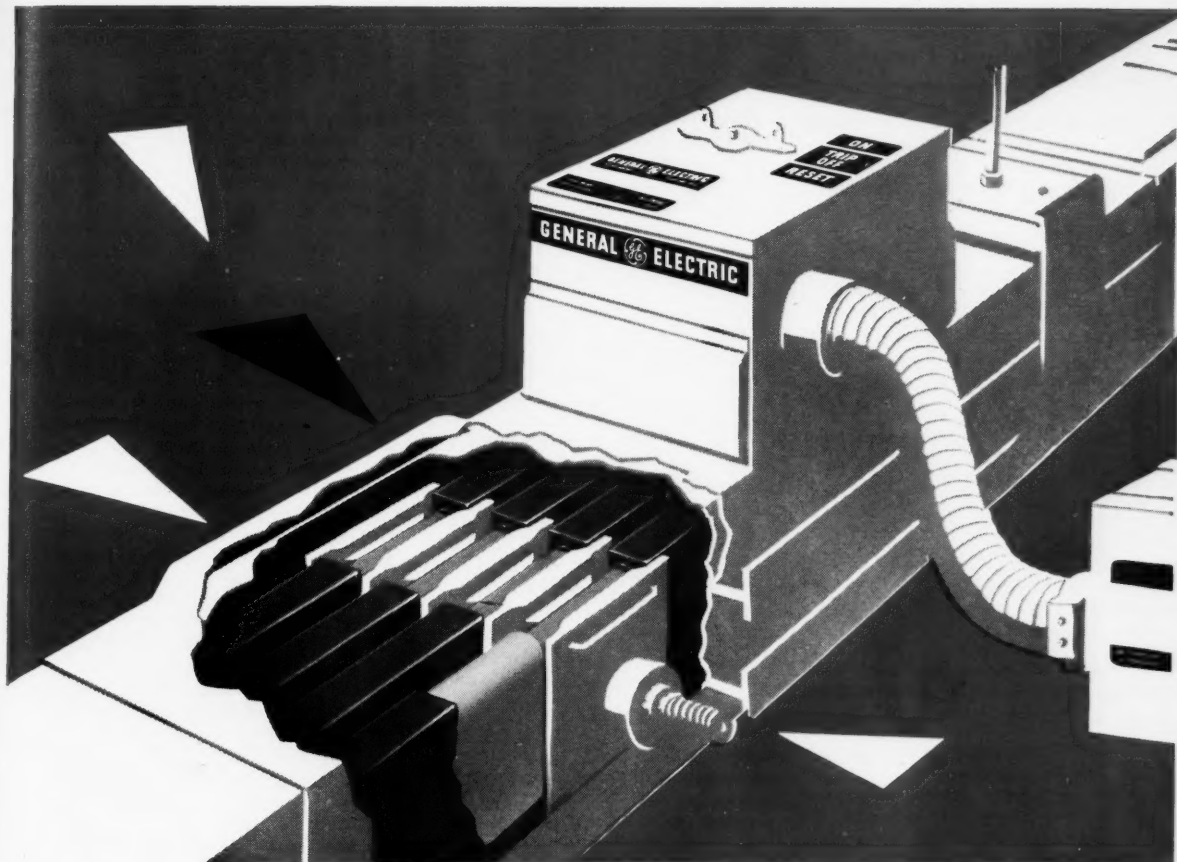


Fabian Bachrach

John D. Hallaren

John D. Hallaren has been named to the newly created post of director of tire cord division of American Rayon Institute, Inc., 350 Fifth Ave., New York, N. Y. He joined the Institute in 1954 as director of public relations, dividing his time among the various fields of apparel, home furnishings, and industrial.

Frank O. Holmes, Jr. has been appointed manager of sales development of United Carbon Co., Inc., Charleston, W. Va. He will have his headquarters in Akron, O., and will be in charge of United Carbon's new technical sales service laboratory there. Most recently, Mr. Holmes was factory manager for W. J. Voit Rubber Corp., Los Angeles, Calif., and earlier had been technical director for Armstrong Tire & Rubber Co., Natchez, Miss. **Gene West** has been appointed southern district sales representative for United Carbon and will serve under District Sales Manager **D. A. Reneau** in Memphis, Tenn.



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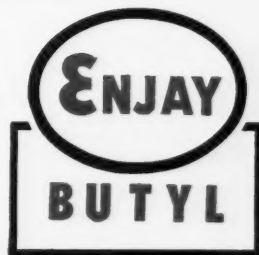
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News about People

Richard W. Eddy has been promoted to the managership, new chemicals division, of Union Carbide Chemicals Co., division of Union Carbide Corp., New York, N. Y. He was assistant manager of this department since 1955.

William K. Hipp has joined Pennsylvania Industrial Chemical Corp.'s New Orleans district office. He will work out of the firm's Houston, Tex., sales residency.

Charles A. Lindsay has been appointed vice president and general manager, molded products division, Stauffer Chemical Co., New York, N. Y.

H. A. Shabaker, of the foreign operations engineering staff of Houdry Process Corp., Philadelphia, Pa., has been appointed technical assistant to **Theodore A. Burtis**, president. **Alexander K. Logwinuk**, senior process engineer, succeeds Shabaker in foreign operations.

Thomas Clinton Hunter has joined the product information section of the advertising, merchandising, and promotion department of Chemstrand Corp., New York, N. Y., manufacturer of synthetic fibers.

Clarence R. Flynn has been named to head the technical department of B. F. Goodrich Chemical Co.'s new general chemicals plant in Henry, Ill., according to Plant Manager Charles B. Cooper.

Heinz Rollman, president of Wellco Shoe Corp. and Ro-Search Inc., both of Waynesville, N. C., and founder of World Construction, was invited by President Eisenhower to attend a meeting of the President's Committee on employment of the Physical Handicapped, held May 8-9 in Washington, D. C.

George Thorn has been named sales manager of the belting division of Boston Woven Hose & Rubber Co., Division of American Biltrite Rubber Co., Boston, Mass., and will direct the overall sales activity of the company's flat belt and V-belt departments.

Kenneth S. Goodyear has joined Stowe-Woodward, Inc., Newton Upper Falls, Mass., as plant manager. He has an extensive background in rubber, having served with United States Rubber Co. for 18 years.

True E. Read has been named special field representative for Pioneer Rubber Co., Willard, O., manufacturer of household, industrial, and surgical gloves, as well as toys and other products. Read was an assistant sales manager for McKesson & Robbins, Inc., before joining Pioneer.

L. W. Adams has been appointed manager of V-belt sales for the Goodyear Tire & Rubber Co., Akron, O., replacing **J. F. Taylor**, retired. Adams, southern region sales manager for Goodyear's industrial products division since 1953, will operate from the firm's belting plant at Lincoln, Neb.

Services were held on March 25 at the Billow Akron Chapel, and interment was in Rose Hill Burial Park. Survivors include the widow, a daughter, and a brother.

Carl F. Lindholm

Carl F. Lindholm, 66, president of Independent Die & Supply Co., St. Louis, Mo., and of New Era Die Co., Red Lion, Pa., passed away on March 7 in St. Louis. Mr. Lindholm came to St. Louis with his father, Carl, in 1905 to start the St. Louis branch of the original Independent Die Co. of Brockton, Mass.

Upon the death of his father in 1916, Carl F. Lindholm took charge of the St. Louis plant and later was joined by his brothers, Courtney and Arthur. The company name was changed to Independent Die & Supply Co., which was incorporated in 1927 and at that time was separated from the Independent Die Co. of Brockton.

The principal ownership was in the name of Mrs. Beata Lindholm after the death of Carl Lindholm in 1916, and in 1952 upon her death it passed into the hands of Agnes, Carl, Courtney, and Arthur Lindholm, daughter and sons.

Carl F. Lindholm was born in Boston, Mass., February 18, 1892. He attended grade and high schools in Brockton.

His great store of knowledge of the cutting die industry and the ever-present kindness and devotion to duty will be greatly missed by his associates.

He is survived by his wife, two daughters, four grandchildren, his sister and brothers.

Morris H. Laatsch, Jr.

Morris H. Laatsch, Jr., manager of service compounding for The Goodyear Tire & Rubber Co., Akron, O., and former technical superintendent at the firm's Gadsden, Ala., plant, died suddenly of a heart attack, March 20, at the age of 41.

Mr. Laatsch joined the Goodyear organization in 1937 as a college trainee, following graduation from Alabama Polytechnic Institute. A year later, he started on the company's compounding operations.

Appointed technical superintendent at the Goodyear Fabric Corp., New Bedford, Mass., in 1947, he remained in that capacity until 1951, when he was named chief chemist at Gadsden. He became technical superintendent there two years later.

Mr. Laatsch was returned to Akron in 1956 as manager of service compounding.

He served four years with the U. S. Army during World War II and was

OBITUARIES

Harold A. Morton

Harold A. Morton, 67, passed away March 22 in an Akron, O., hospital after an illness of two months. He was president of the Rubber Latex Products Co., Cuyahoga Falls, O., and also of Chemico, Inc., and Harrison-Morton Laboratories, both of Akron.

Dr. Morton was a chemical engineer and chemist in the rubber industry for 38 years. He was granted his bachelor's degree in chemistry from Clark University in Worcester, Mass., his birthplace, in 1912. After receiving his master's degree from Clark the following year, he got his Ph.D. in chemistry

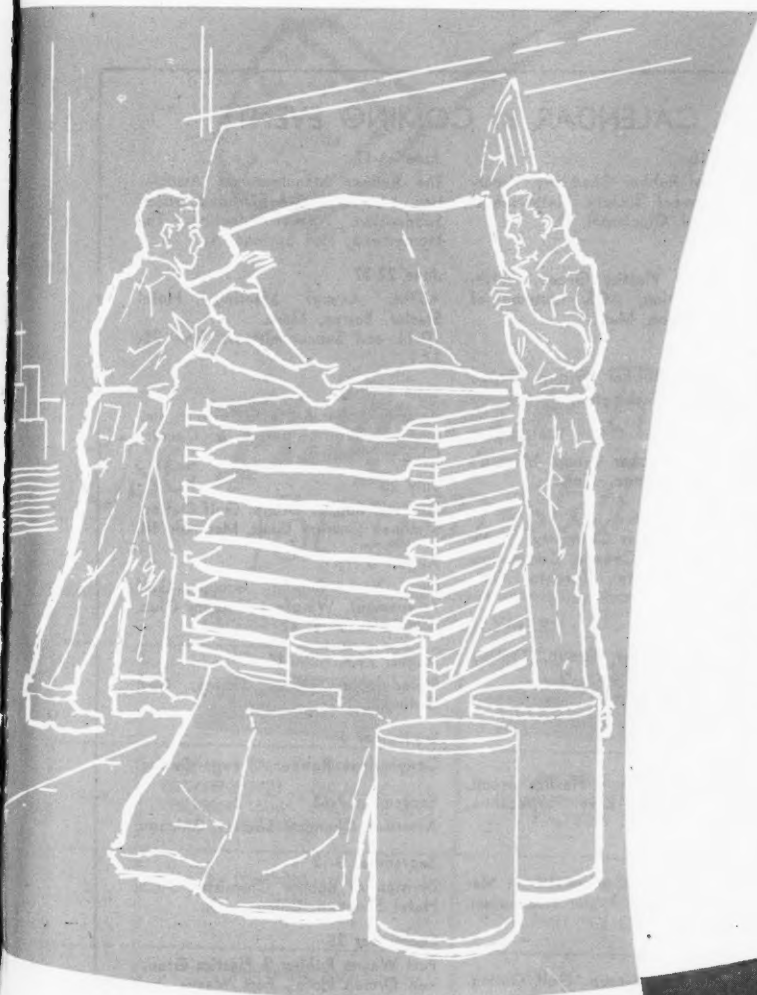
from the University of Pittsburgh in 1915.

The deceased went to Akron in 1920 and became research director for the Miller Rubber Co. He stayed in research there after the company was absorbed by The B. F. Goodrich Co. in 1930. In 1939 he and the late Dr. M. M. Harrison, another Miller Rubber Co. chemist, resigned to form the Harrison & Morton research firm. Both the Rubber Latex and Chemico firms are offshoots from that original firm.

Dr. Morton belonged to the West Congregational Church, the American Chemical Society, and Akron City Club.

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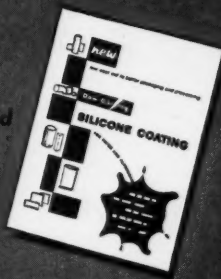
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Obituaries

separated from service in 1946 in rank of Major.

Surviving are his widow, three sons, four daughters, his parents, and two sisters.

Austin L. Hawk

Austin L. Hawk, a sales executive of the Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, N. J., died of a heart attack in a Cleveland, O. hospital on March 21.

Mr. Hawk started in the Chicago office of Manhattan Rubber in 1929 as a clerk and progressed to field sales representative, manager of distributor sales, Chicago district manager, and manager, central sales region, the position he held at the time of his death. He worked closely with many people in the mining, quarry, steel, oil, and other industries.

The deceased was born in Grants, Mo., 47 years ago. Surviving are his wife, two sons, his parents, two sisters, and a brother.

The memorial service was held at Glenview Community Church in Glenview, Ill.

Robert L. Hutchison

Robert L. Hutchison, 54, vice president in charge of operations and a member of the board of directors of Columbia-Southern Chemical Corp., Pittsburgh, Pa., was killed on March 21 in an automobile collision en route to his office.

Mr. Hutchison joined the company as a draftsman at the Barberton, O., chemical plant. He held various positions in the experimental engineering department of Barberton and served as superintendent of the plant from 1940 to 1947.

He moved to the general offices in Pittsburgh in 1947 as general superintendent for the company and later served as general manager of operations. He was elected a vice president and a director in 1955.

A native of Aberdeen, Scotland, he was educated at Gordon's Technical College at Aberdeen.

He is survived by his widow, one son, and two daughters.

Frank F. Meads

Frank F. Meads, a chemist for Converse Rubber Co., Malden, Mass., died unexpectedly on March 25 of an embolism following an operation.

Mr. Meads started with the company in April, 1925, as a laboratory technician, aiding the head chemist in the development of new rubber

compounds. He was later given the position and title of chemist in charge of compounding, a position which he held until his death.

During World War II he aided the government in the use of synthetic rubber. He also assisted a committee set up by the government for the improving of natural rubber after the war. He was also an active member of the Boston Rubber Group.

The deceased was born in Dover, N. H., on November 10, 1899.

Funeral services were held on March 27 at the First Congregational Church, Reading, Mass.

Interment was at the Forest Glen Cemetery, Reading.

Survivors are the widow, one son, two daughters, a sister, and nine grandchildren.

Charles R. Ross

Charles R. Ross, 32, field representative for The Goodyear Tire & Rubber Co.'s industrial products division, was killed April 6 in an airline crash near Tri-City airport in Michigan. He was returning from Saginaw after spending Easter Sunday with relatives at Ligonier, Pa., when the plane plunged into a cornfield, killing Ross and 46 others.

A bachelor, the deceased is survived by his widowed mother and a brother, Arthur, a field representative for Goodyear's industrial products division in the Johnstown, Pa., territory.

Born at Detroit, Mich., Ross attended Wayne University and served three years in the army before joining Goodyear in 1953.

CALENDAR of COMING EVENTS

May 13-16

Division of Rubber Chemistry, American Chemical Society. Netherlands Plaza Hotel, Cincinnati, O.

May 20

Elastomer & Plastics Group, Northeastern Section, ACS. Museum of Science, Boston, Mass.

May 21

Washington Rubber Group. Pepco Auditorium, Washington, D. C.

May 23

Connecticut Rubber Group. Manero's Restaurant, Orange, Conn.

May 28

Division of Rubber Chemistry, Chemical Institute of Canada. Convention. Royal York Hotel, Toronto, Ont., Canada.

June 5

New York Rubber Group. Outing. Doerr's Grove, Milburn, N. J.
Rhode Island Rubber Club. Outing. Pawtucket Country Club.

June 6

Fort Wayne Rubber & Plastics Group. Summer Outing. Lake Tippecanoe, Leesburg, Ind.

June 9-12

ASME, National Conference on Materials Handling. Public Auditorium, Cleveland, O.

June 10

Buffalo Rubber Group. Golf Outing. Lancaster Country Club.

June 13

Boston Rubber Group. Outing. Andover Country Club, Andover, Mass.

June 13-14

Southern Rubber Group. Dinkler Plaza Hotel, Atlanta, Ga.

June 16-17

The Rubber Manufacturers Association, Inc., Molded & Extruded Goods Subdivision. Annual Meeting. The Homestead, Hot Springs, Va.

June 22-27

ASTM. Annual Meeting. Hotel Statler, Boston, Mass.
[D-11 and Subcommittees, June 25-27.]

June 27

Detroit Rubber & Plastics Group, Inc. Outing. Western Golf & Country Club.

July 25

Chicago Rubber Group. Golf Outing. Medinah Country Club, Medinah, Ill.

August 5

New York Rubber Group. Golf Tournament. Wingfoot Country Club, Mamaroneck, N. Y.

August 22

Philadelphia Rubber Group. Golf Outing.

September 6

Connecticut Rubber Group. Outing.

September 7-12

American Chemical Society. Chicago.

September 9-12

Division of Rubber Chemistry, ACS. Hotel Sherman, Chicago, Ill.

September 25

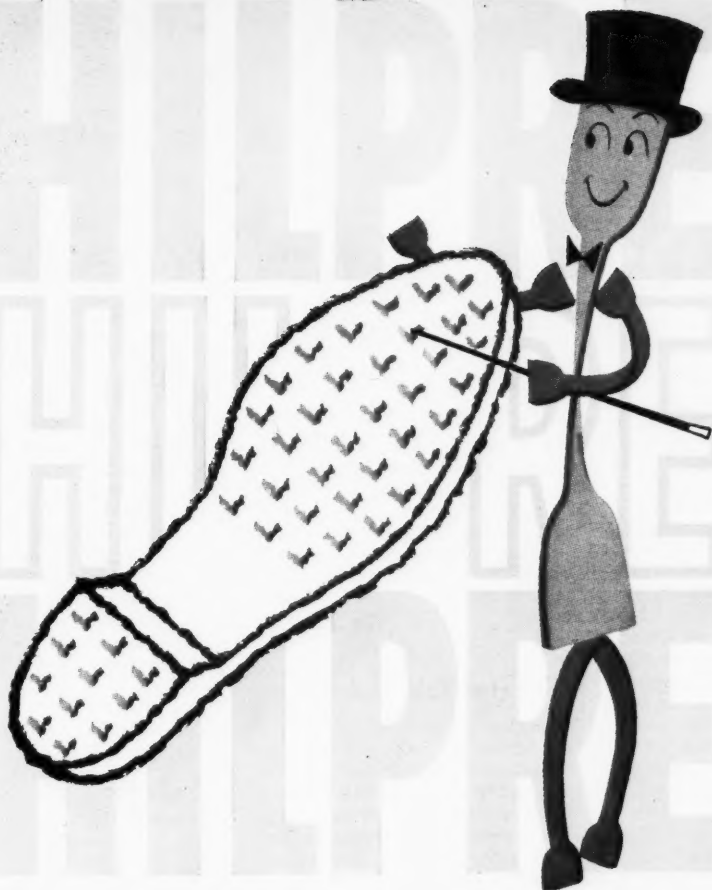
Fort Wayne Rubber & Plastics Group. Van Orman Hotel, Fort Wayne, Ind.

October 3



Detroit Rubber & Plastics Group, Inc. Fall Meeting. Detroit-Leland Hotel, Detroit, Mich.

October 7

The Los Angeles Rubber Group, Inc. Biltmore Hotel, Los Angeles, Calif.



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NEWS

from ABROAD

USSR

Synthetic Polyisoprene

Work on the use of Ziegler-type catalysts for the polymerization of isoprene has also been proceeding in Russia, as recent publications reveal.¹ The Russian investigators used a 20-25% (by volume) solution of isoprene in benzene, adding as polymerization catalyst triethyl aluminum and titanium tetrachloride, on the basis of 0.3-0.6% by weight of the monomer. The tests were begun at room temperature with a rise to 40-60° C. during the process. Polymerization usually took 5-6 hours, and the reaction mass was treated with alcohol, and the precipitated rubber dried on rolls. Table 1 gives information on the molecular weight and structure of the polyisoprene obtained under selected conditions.

In stability tests, in which the variation in plasticity of the polyisoprene stabilized with different antioxidants and stored at 20° C. was measured, phenyl- β -naphthylamine proved the least satisfactory; while aldol- α -naphthylamine gave the best results. When processed on the usual rubber equipment, synthetic polyisoprene behaved similarly to natural rubber, rapidly forming a continuous sheet that mixed well with the ingredients and yielded smooth-surfaced extrusions. Mixes consisting of 100 parts by weight of polymer, two of stearic acid, three diphenylguanidine, 0.6 dibenzothiazyl disulfide, five ZnO, and one of sulfur, for the most part vulcanized at 134° C., gave tensile values (for unfilled mixes) 250-280 kg/cm²; elongation at break, 800%; permanent set 16%; moduli, 11 to 20 kg/cm² at 300% and 24-40 kg/cm² at 500%.

At elevated temperatures, the strength of unfilled polyisoprene vulcanizates fell more rapidly than for

natural rubber. Rebound of the unfilled polymer vulcanizates was similar to that of natural rubber both at ordinary and elevated temperatures.

While the authors mention that carbon black reinforced vulcanizates were also tested, no data related to these are given.

Oil-Extended Rubber

A report on Russian research on oil/rubber batches has been published by E. A. Kalans and coworkers.² For this work synthetic latex type SKS-30A was used. This latex is prepared by a redox catalyst system with diperoxide or diethyl-xanthogen-disulfide as regulator. Polymerization is carried out at 5-8° C. to about 60-63% of the monomer present; reaction time is 13-15 hours. Residual butadiene is removed at about 50° C. under slightly reduced pressure; then styrene is removed by live steam in vacuum. Small quantities of iron stearate or other fatty acid soap are added before coagulation to improve processing of the rubber. When the latex is to be used for oil/rubber batches, the regulator is omitted. In general, omission of the regulator results in higher molecular weight, greater hardness, and improved tensile strength.

The most suitable mineral oils were found to be those containing not less than 40% aromatic hydrocarbons; and among them is included Avtol-18 and a Russian oil, PN-6. Tests were conducted with tread compounds containing 50 parts by weight of carbon black,

with Altax-DPG as accelerators and 15-30% of oil. With oil content more than 20%, tensile strength fell off markedly, and tear strength dropped when oil was increased above 15%. Elongation at break was little affected; elasticity at 20° C. was lowered by oil, but at elevated temperatures this effect diminished, and at 100° C. elasticity was greater than for the rubber without oil. Brittle point rose with increased oil content, and heat build-up was reduced.

In view of the problems connected with the drying of the material by the usual means for synthetic rubber, the oil content is as present kept at 14-17%, or 16.5-25% by weight, in the so-called SKS-30AM-15 rubbers, but it is hoped eventually to develop new oil/rubber batches with higher oil content.

To prepare the batches, the oil is first emulsified by mixing with stearic acid or a synthetic fatty acid and stirring in water containing triethanolamine, at about 40-50° C. Then the emulsion is mixed with the latex for one to two minutes; after which mixing coagulation is effected by means of aqueous calcium chloride solution and acetic acid (it is noted that magnesium or sodium chloride may have advantages). The resultant slurry passes through two more mixers to a ripening tank from which it is pumped to a traveling screen where the serum is filtered off, and the rubber is formed into a strip. Then it is washed, compacted, and dried. The oil loss during the processing is about 1% and occurs chiefly during drying. It is noted that the amounts of calcium chloride and acetic acid used for coagulation are increased over those used for SKS-30A, the rubber without oil, and the water is reduced by about half. Table 2 compares the composition of the two types:

TABLE 2
SKS-30AM SKS-30A

| | % | % |
|-------------|-------------|-------------|
| Oil | 14-17 | 0 |
| Fatty acids | 1.3-1.8 | 0.6-0.8 |
| Ash | 0.5-0.8 | 0.4-0.6 |
| Nekal | 2.5-3.0 | 1.9-2.3 |
| Iron | 0.014-0.018 | 0.012-0.014 |
| Neozone D | 2.3-3.0 | 2.3-2.8 |
| Moisture | 0.2-0.7 | 0.2-0.5 |

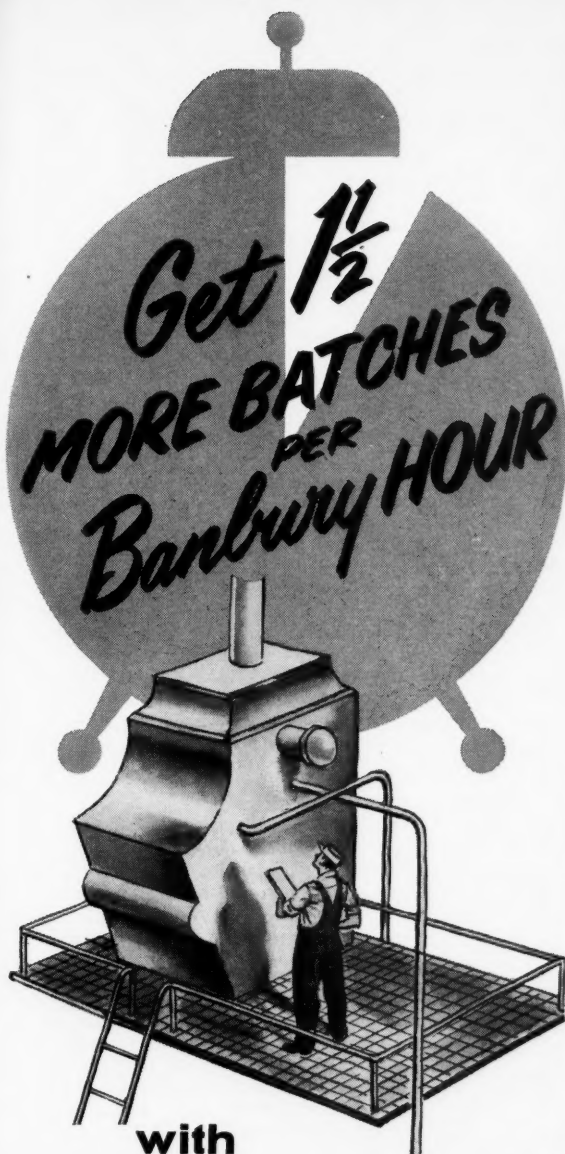
In road tests, oil-extended rubber treads (presumably with 14-17% oil) gave better results than those of normal synthetic rubber. On the best types of roads, ordinary synthetic rubber tires gave a mileage of about 27,000 miles before they became unfit for service; the mileage was greater for oil-extended treads, and 90% of the tires were still serviceable.

TABLE 1

| No. | Yield of Polymer % | Molecular Weight $\times 10^5$ | Degree of Unsaturation % | Structure (in % of Links) | | | | Glass Transition Temp., °C. |
|----------------|--------------------|--------------------------------|--------------------------|---------------------------|-----|-----|-------|-----------------------------|
| | | | | 1,2 | 3,4 | Cis | Trans | |
| 1 | 80 | 3.40 | — | — | — | — | — | -73 |
| 2 | 93 | 2.90 | 95.5 | — | — | — | — | -69 |
| 3 | 90 | 2.50 | — | — | — | — | — | -70 |
| 4 | 90 | 2.90 | 97.2 | — | — | — | — | — |
| 5 | 60 | 3.25 | 98.1 | 3 | 4 | 93 | 0 | — |
| 6 | 55 | — | 95.0 | 3 | 3 | 94 | 0 | — |
| Natural rubber | 5.00 | — | 98.0 | 0 | 3 | 97 | 0 | -70 |

Polymer Output Upped

The news from Russia reveals that a drive is now under way to make the Soviet Union "the world's largest producer of polymers" in the next few



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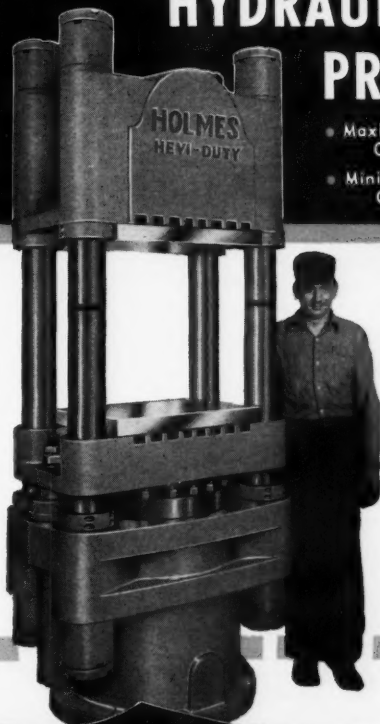
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years. The Soviet Government demands a 53.6% increase this year in investment in the state chemical industry; construction for the synthetics industry is to be increased by 150%, and outputs of synthetic fiber and synthetic rubber are to be 75 and 48% higher, respectively. The best efforts of the best chemists and the best research institutes are to be diverted to the realization of the ambitious polymer program.

Malaya

Recent NR Developments

Rubber research in Malaya has of late been subjected to criticism so that some of the studies conducted at the Rubber Research Institute, reported in recent issues of the *Planters' Bulletin*, deserve special attention.

In Malaya, we learn, the largest single factor reducing potential yields is root disease, which poses the greatest problems in replanting. With the present high cost of labor, the elaborate measures formerly advocated are no longer economic; indeed investigators have found that less meticulous methods are more effective in controlling the disease, and the aim now is to seek simpler ways of keeping plantings free of root disease.

As a result of work on the dirt content of Malayan rubber, especially sheet, the Institute is in a position to certify a specified dirt content for an estate, if this service is required. Shipping trials have proved the usefulness of multiple paper bags or hessian with a polyethylene liner if especially clean rubber must be supplied.

Studies on latex concentrates have revealed the value of the volatile fatty acid content (VFA) in locating the cause of poor quality latex; bacteria cause volatile fatty acids to form, and it is pointed out that the fact that the VFA number of commercial latex today is rarely higher than 0.05, against more than 0.20 in 1950, is at the same time an indication of the trend toward upgrading the Malayan product. It is hoped that research now in progress will make it possible to predict and ultimately to control the behavior of natural latex concentrates during storage. The search for new systems of preserving latex using less ammonia has indicated, as a particularly successful combination, 0.2% ammonia and 0.2% boric acid; certain accelerators have also proved effective.

The development section of the Institute's chemical division is being steadily expanded, and facilities improved, with the development of new modified rubbers in view. In this connection the continued progress made with Superior Processing Rubber may be mentioned. In 1956, total output of

SP smoked sheet was 11 tons; in the four quarters of 1957, the average monthly shipments were 5, 9, 23, and 34 tons, respectively, and the total for the year came to 240 tons. SP crepe continues to be produced by the East Asiatic Co., at Taiping; output last year was 70 tons, but the lively interest shown in this product by manufacturers gives reason to expect a considerable increase this year.

SP airdried sheet, made only at the Rubber Research Institute Experimental Station, is intended for the manufacture of light-colored goods. In 1957, 27 tons were shipped. Incidentally, we note that a modification in the formulation of the vulcanized portion of SP rubber permits a reduction in the price of the material. Experiments to produce SP estate brown and remilled grades have also been carried out, and trial quantities are to be sent to manufacturers for evaluation.

Stocks of SP sheet, crepe, and airdried sheet are on hand in London, New York, Paris, Genoa, Tokyo, Melbourne, and New Zealand, to supply samples immediately they are requested.

The Labor Situation

Labor difficulties are brewing for the rubber plantation industry as a result of a decision of the MPIEA (the employers' association) to reduce daily wage rates for the quarter starting April 1, it is reported. The cut, amounting to 30 (Straits) cents a day, was considered justified because the average price of rubber dropped to the 60-80 cents per pound zone during the preceding quarter; the former rate had been based on a price between 80 cents and \$1.00. But the agreement between the Plantations Workers' Union and the MPIEA, permitting the adjustment of wages to price, expired April 1, and the Union had given three-months previous notice of cancellation, at the same time demanding a new wage structure.

To the end of March the disputing parties had not been able to negotiate a new wage system, and the MPIEA resolved meanwhile to follow the terms of the old agreement. Under the circumstances the Union considered the wage cut an "arbitrary action" and has warned employers that they would be responsible for any unrest among workers resulting from this act.

New Planting Scheme

If the Malayan Government will give the land, there are capital and enterprise in Malaya to plant up 1,000,000 acres with rubber in the next 10 years, Leong Hoe Yeng, the new president of the Rubber Producers' Council, is

reported as saying early in March. Three-quarters of Malaya is still virgin jungle, he added, and most of it is suitable for rubber planting.

Following closely on this statement came the announcement of a new planting scheme for small holders that has been laid before the Federal Legislative Council. Under the Rubber Industry (Smallholders New Planting) Scheme, 1957, as it is called, \$30,000,000 (Straits) of the funds voted for the government's \$280,000,000-replanting scheme a few years ago, is to be used to aid smallholders to plant new rubber. The scheme provides for block-planting, with individual smallholders obtaining not less than six acres of rubber land in addition to an adjoining piece of land of two acres which must be reserved for other crops.

From details published in the daily press, one gathers that the new plan envisages two types of projects: One type would be started by smallholders who would apply as a group for a block of land near enough to their kampongs to permit them to continue living there while working on the new block. These blocks would cover up to 500 acres and not less than 250 acres. The second type of project apparently would consist of large areas of 4,000 to 5,000 acres from virgin jungle land and would be started by State Land Development Boards. These large projects would involve the creation of new communities with houses, schools, and mosques and would require the resettling of entire families.


Smallholders eligible for the holdings in either type of project are those who own not more than 10 acres of rubber land and are Federal citizens. The land must not be sold for 10 years after the first installment of aid has been received, and planting, with high-yielding rubber, will be under government-approved supervision.

It has been estimated that the money earmarked for the scheme will permit planting of 75,000 acres of high grade rubber.

Notes

A note in the January, 1958, issue of the *Planters' Bulletin* states that more than 600 *Hevea* plants have been established after germinating 1,000 seeds treated with high energy radiations. No abnormalities have as yet been observed among the survivors.

The Hungarian Government is anxious to make direct purchases of rubber from Malaya and Indonesia, the leader of the Hungarian delegation to the E.C.A.F.E. Conference is reported to have stated in Kuala Lumpur. Hungary is ready to buy about 10,000 tons annually from Malaya. She intends to make an intensive drive to open purchasing possibilities in the E.C.A.F.E. area, the delegate added.



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Let's talk tires

"Bag-O-Matic" presses are enjoying increased popularity in the tire industry. But, the high operating temperature of these presses puts severe demands on rubber lubricants. Lubricants must perform efficiently under these new conditions. That's why you should consider UCON rubber lubricants in "Bag-O-Matic" presses.


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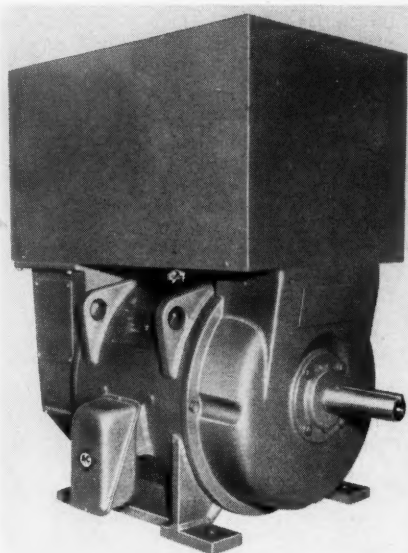
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NEW

EQUIPMENT



A-C totally enclosed motor

New Enclosed D.C. Motors

Introduction of a line of totally enclosed motors with self-contained heat exchanger cooling for operation in highly contaminated atmospheres has been announced by Allis-Chalmers Mfg. Co., Milwaukee, Wis. Available in constant or adjustable speeds in frame sizes of EB-120 and up and in ratings from 10 through 200 hp., these motors are designed for machine tool, steel mill drive, paper mill, cement, and rubber plant applications as well as for use in other locations having airborne foreign matter.

The motor's independent cooling system is unaffected by the speed of the motor, and a thermostatic relay in the hot air stream at the commutator end shuts down the drive or operates an alarm in case of blower motor power failure.

Wiring is made easier and inspection simplified by means of separate conduit boxes for the d.c. motor and the heat exchanger unit. Filters which can be cleaned during routine maintenance sift impurities from the outside air entering the heat exchanger.

Available as a unit, the d.c. motor heat exchanger combination is constructed so as to allow top, sidewall, or ceiling mounting. The self-contained heat exchanger unit can be quickly removed for maintenance, and removable gasketed covers permit fast accessibility to d.c. motor brushes and commutator.

Construction and design features of the new motors are described in Bulletin 53B8904, copies of which are available from the company.

New Automatic Trimmer

Double impression cutting is eliminated, and die life is doubled by a new roll lift feature which Falls Engineering & Machine Co., Cuyahoga Falls, O., has built into its newest automatic trimmer for molded rubber goods.

When the roll traverses the die, making the trim or necessary



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● Rubber rolls being removed from vulcanizing oven at Stowe-Woodward, Inc., Newton Upper Falls, Mass. Other roll covering plants located at Neenah, Wisc. and Griffin, Ga.

Rubber rolls are basic production tools in such industries as paper making and textile finishing. And though seemingly uncomplicated, they are actually quite complex, in the making, for the finished roll must offer just the right combination of hardness and durability, good gripping surface and low-cost maintenance with minimum down-time. Fabric plays an important part in establishing these qualities—as a cure wrap, wound tightly around the rubber surface, it holds the uncured rubber firmly, maintains the shape while the roll goes through high-temperature vulcanizing.

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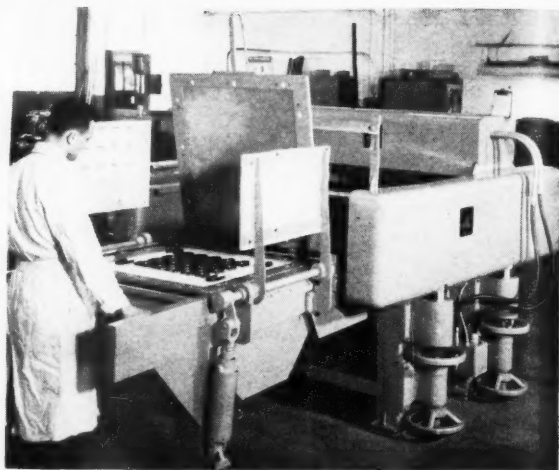
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New Equipment



Femco's automatic "roll lift" trimmer

cuts, the new feature automatically lifts the heavy roller off the die, and it idles back to the starting position, instead of rolling back over the die, as was the case in Femco's earlier models of the automatic trimmer.

This construction means greater accuracy in cutting, the firm claims, because a double impression may be off register. Die life is doubled because the number of impressions of the heavy roller against the die is cut exactly in half with each operation.

Designed by Campbell Machinery Development Co., the new automatic trimmer will handle entire sheets of mechanical molded rubber goods on an around-the-clock basis, the company reports. The machine is equipped with a motorized traversing steel roll assembly which provides the cutting pressure on clam-shell dies. The dies are locked in two frames, one upper, and one lower. The sheet of molded rubber goods, direct from the curing press, is placed on top of the die in the lower frame. The operator pushes a button, and the upper and the lower dies close against the stock. Then the traversing roll makes the cut and passes to the far end of the machine where the roll is automatically lifted and idles back to the starting position ready for the next cut.

As the cutting roll returns to its original position, the dies are automatically pulled from the trimmer and opened. Scrap rubber is removed by the operator, and the lower die opens to discharge the trimmed parts. At this point right- and left-hand knock-out assemblies jar the trimmed goods loose from the die, and they drop into a tote box or take-away conveyor.

The only manual operations required with this machine are loading the dies and removing the scrap. The trimmer will handle a sheet of molded rubber goods to a maximum size of 30 by 30 inches, and it occupies floor space approximately 8 by 12 feet.

The new automatic trimmer develops cutting pressure through limit controlled traversing roll mechanism and a three hp. 1,800-rpm. 220- or 440-volt, three-phase 60-cycle Reuland magnetic brake motor. The clam-shell action of the dies is controlled by automatic sequence apparatus and a ½-hp. 1,800-rpm. Reuland brake motor. Knock-out assemblies are operated by 40 to 80 psi. filtered air.

More information on this trimmer is available from Falls.

"Elmes Hydraulic Presses and Equipment," Bulletin 5200-A. Elmes Engineering Division, American Steel Foundries, Cincinnati, O. This bulletin covers the complete line of Elmes hydraulic presses and equipment for the plastics and rubber molding industries. It illustrates and gives descriptions and principal specifications of the company's compression and transfer molding presses, air-operated "Hydrolair" presses, hobbing presses, and laboratory presses.

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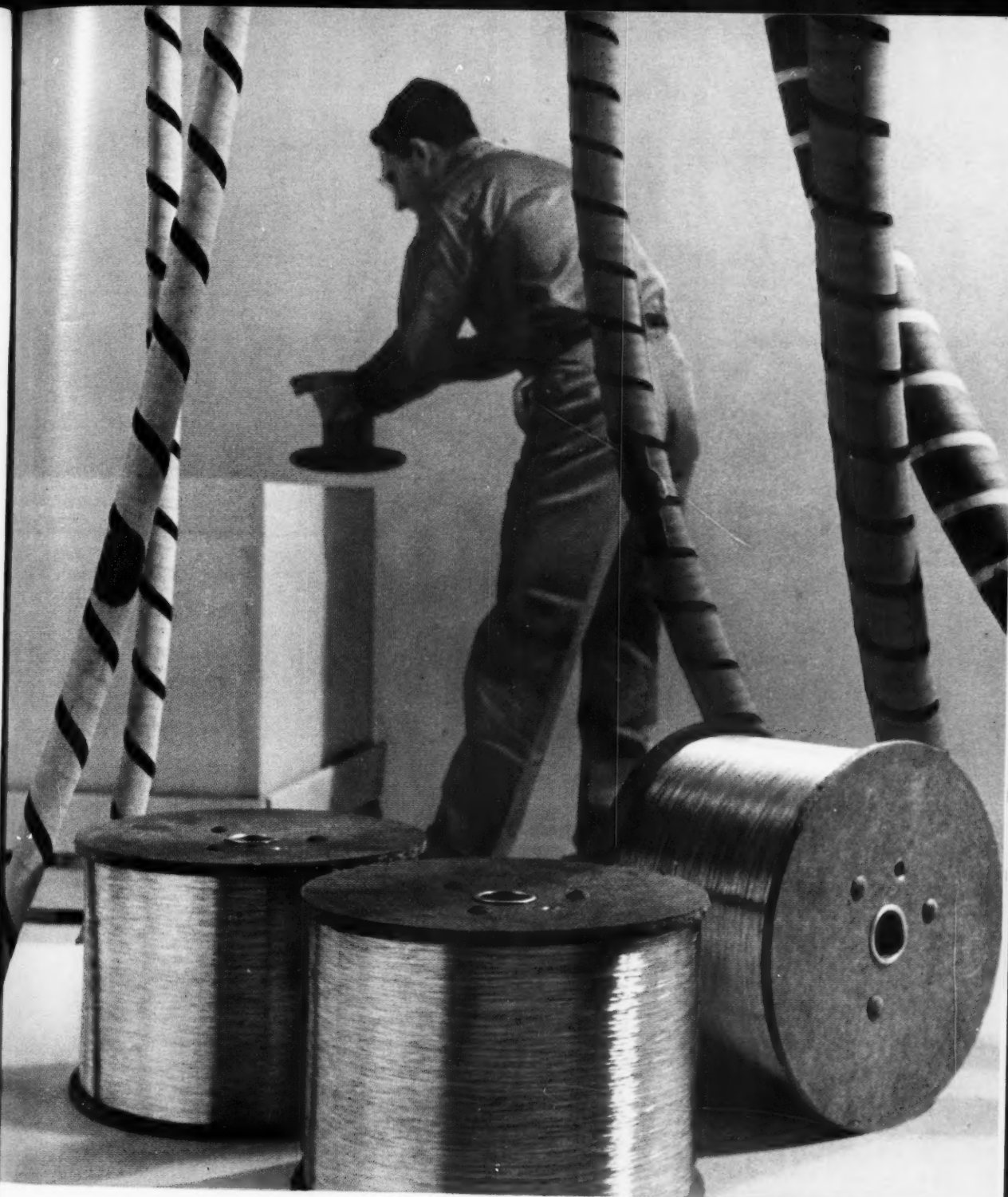
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How to strengthen the grip of a solvent-type adhesive

Have you been thinking of phenolic resins mainly as agents for compounding hard and semi-hard rubber stocks?

Then you may be overlooking one of phenolics' most interesting roles—as reinforcing agents in solvent-type adhesives.

You can produce excellent adhesives using Durez resins with nitrile rubber, natural rubber, and Neoprene. These resins have also been used successfully for bonding nitrile rubber stocks to metals.

Nitrile rubber solvent cements

You get strong bonds that become even stronger on aging, with Durez resins as modifiers in nitrile rubber cements.



Such adhesives have been used extensively by the shoe industry and are particularly well suited for applications involving the bonding of vinyls. They are also finding widespread use as general-purpose adhesives.

The resins are highly compatible with nitrile rubber. They are soluble in acetone and methyl ethyl ketone, the solvents normally employed in these cements. From 30 to 75 parts of resin are used per 100 parts of nitrile rubber, depending upon the degree of reinforcement, hardness, or flexibility required in the adhesive film.

For most applications, only room-temperature cures are necessary. However, when you need greater bonding strength and heat resistance, curing at 250°F or higher gives a noticeable improvement.

Nitrile rubber-to-metal bonds

You can greatly simplify the bonding of cured and uncured nitrile rubber compounds to most metals by using specific Durez resins.

Good adhesions are obtained to copper, brass, aluminum, tin plate, and regular and stainless steel. Medium good adhesions are obtained to zinc plate and galvanized steel.

Dissolved in recommended solvents,

the resin is applied to the prepared metal surface and air dried to eliminate the solvent. In bonding uncured stocks, the bond is obtained during vulcanization of the compound.

Neoprene solvent cements

Neoprene cements modified with a Durez resin give good adhesion to a variety of surfaces including most metals, wood, leather, and Neoprene, and fair adhesion to natural rubber.



Neoprene Type AC is generally used. The optimum amount of resin to use for good adhesion to all surfaces is 100 to 125% on the weight of the Neoprene.

Natural rubber solvent cements

Still another Durez resin has been used

extensively as a modifying ingredient for natural rubber solvent cements, particularly in adhesives used by the shoe industry.



This material is a tough, high-melting thermoplastic resin possessing heavy viscosity or body. It greatly reinforces the adhesive film and, without reducing adhesive properties, it decreases the tendency of such cements to string, thus resulting in a stronger bond immediately.

Because of its high melting point and heavy viscosity in the molten condition, this resin improves bond strength at elevated room temperatures.

Normally 15 to 30 parts of resin on the weight of natural rubber are used in formulating, the amount depending on tackiness, hardness, and temperature resistance required.

Where else can Durez resins help you get properties you want?

Nitrile rubber compounds • Completely compatible with nitrile rubbers, Durez resins soften and plasticize the stock during processing, then aid vulcanization with substantial gains in strength, hardness, stiffness, abrasion resistance, heat and chemical resistance of the final cured stock. Compatibility and reactivity increase with increasing nitrile content.

GRS and natural rubber compounds • As plasticizers, Durez resins impart hardness, stiffness, and abrasion resistance

to compounded stocks of GRS and natural rubber. Hardness and stiffness are retained at high temperatures. Compatibility with GRS is improved by using some nitrile rubber in the recipe.

Synthetic rubber latices • A highly effective means of hardening and reinforcing nitrile rubber latices is the use of Durez resin emulsions developed for this purpose. For modifying the properties of latex-treated papers, a water-soluble liquid resin is available. So far, the use of these resins is confined mainly to nitrile rubber latices. However, one Durez resin has produced very satisfactory results with certain high-styrene-butadiene latices.

For a more complete description of the application of Durez resins in solvent cements, in compounding, and in modification of latices, write for the illustrated bulletin, "Durez Resins in the Rubber Industry."



PLASTICS DIVISION

HOOKEE ELECTROCHEMICAL COMPANY

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NEW

MATERIALS

Chemigum N8 Rubber

Chemigum N8, a new medium acrylonitrile-content rubber, (NBR) developed to meet the need of a nitrile polymer exhibiting low nerve and shrinkage characteristics and for more exacting reproduction of extrusion die shape, calender gage, and embossment, has been developed by the chemical division of The Goodyear Tire & Rubber Co., Akron, O. Especially applicable to extrusion and calendaring operations, the new NBR demonstrates excellent mill breakdown properties and accepts pigment readily. It is stabilized with a non-staining antioxidant which supplements the good color of the base polymer.

Substitution or blends of Chemigum N8 in existing compounds produce higher modulus and lower elongation. In addition, the new rubber exhibits exceptional hardness and compression set and promotes smooth calendaring, good mold flow and excellent die reproductions, even in the 40 to 50 Shore A hardness range.

Low nerve and high stability characteristics of Chemigum N8 suggest its use in such applications as modification of crash-pad skins, seals, rings, gaskets, industrial tubing and hoses, belts, and shoe soles.

Some typical gum properties of Chemigum N8 follow:

| | |
|--------------------------------------|---------------|
| Acrylonitrile content, % | 32 |
| Specific gravity | 0.98 |
| Mooney plasticity M/L @ 212° F./1.5' | 90 |
| Gel, % | 70 |
| Ash, % | 0.80 |
| Polymer, % | 96 |
| Antioxidant | non-staining |
| % | 2 |
| Color | creamy-white |
| Odor | mild-pleasant |
| Storage stability | excellent |

A Tech-Book Fact bulletin, "Extrusion Study Using Chemigum N8," 58-17, describing various formulations and test results using the new rubber, is available from the company.

Cydac Flaked-Form Accelerator

The delayed-action rubber vulcanization accelerator, N-cyclohexyl-benzothiazole-2-sulfenamide, has been developed in flaked form by American Cyanamid Co.'s rubber chemicals department. Called Cydac¹ accelerator, the flaked product is designed to eliminate the caking usually associated with currently available forms of this accelerator, and it is expected that its free-flowing properties will be of particular advantage in automatic compounding of rubber for tire treads, footwear, soles and heels, and similar products.

Some typical properties of Cydac flakes are as follows:

| | |
|-----------------------|--|
| Typical melting range | 203-212° F. |
| Specific gravity | approx. 1.25 |
| Methanol insolubles | less than 1% |
| Dispersibility | Disperses readily under ordinary mixing conditions at temperatures as low as 150° F. |

The addition of Cydac flakes completes Cyanamid's line of rubber accelerators, which ranges from fast-curing mercapto-benzothiazole to the delayed-action DIBS,¹ N,N-diisopropyl

benzothiazole-2-sulfenamide. With respect to processing safety, Cydac occupies a position between MBTS, benzothiazyl disulfide, and NOBS,¹ N-oxydiethylene benzothiazole-2-sulfenamide accelerators.

Samples of Cydac accelerator and a technical data sheet are available from Cyanamid's rubber chemicals department, Bound Brook, N. J.

Silicone Rubber RTV 81774, 81813

The silicone products department, General Electric Co., Watford, N. Y., has announced two new room-temperature vulcanizing (RTV) compounds designed to meet the special needs of the aircraft industry. They are designated 81774 and 81813. The former is supplied as a material of 10,000-15,000 poise viscosity and is best suited for application by spreading or with a calking gun. Much more fluid at 600-800 poises, 81813 can be poured in place. For both, pot life can be varied from a few minutes to days through selection of curing agent and handling technique. Variations in type and concentration of curing agent can also vary cure time in place from a few hours to three days.

Although these RTV compounds do not require the heat cure ordinarily used for silicone rubber, they possess much of the long-term heat resistance and low-temperature flexibility unique to silicone rubber. In addition, these compounds exhibit outstanding resistance to ozone, weathering, and aging. Bonding of these compounds to aluminum, copper, stainless steel, and other metals and to other materials such as glass, ceramics, and plastics is easily done. Such bonds are actually stronger than the elastomer itself at temperatures as high as 625° F., it is said.

Typical physical properties of 81774 and 81813 (measured on a standard ASTM test slab after a cure of 72 hours at 80° F.) are as follows:

| | 81774 | 81813 |
|------------------------|-------|-------|
| Specific gravity | 1.45 | 1.45 |
| Hardness, Shore A | 60 | 65 |
| Tensile strength, psi. | 700 | 650 |
| Elongation, % | 140 | 80 |
| Tear strength, lb./in. | 50 | 50 |

Only slight losses in the above values result after extended heat aging at temperatures up to 500° F. After exposure at 600° F. for 40 hours, hardness will be about 55; tensile strength, 525 psi.; and elongation, 199%.

Naugawhite Antioxidant

United States Rubber Co.'s Naugatuck Chemical Division, Naugatuck, Conn., is now marketing a new, low-cost antioxidant, Naugawhite. It is reported to be an effective, non-discoloring, non-staining, general-purpose antioxidant for use in both dry rubber and latex compounding. Chemically, it is an alkylated phenol. Physically, it is a clear amber liquid of moderate viscosity and a specific gravity of 0.96.

In general, from 1.0 to 2.0 parts of Naugawhite per 100 parts of RHC will be found sufficient to insure good service aging resistance. The antioxidant can be weighed directly into the powdered ingredients and will be found to disperse readily and thoroughly under standard mill or Banbury mixing conditions.

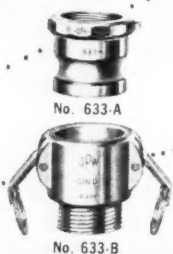
Naugawhite is claimed to protect natural and synthetic rubber against light, heat, and oxygen. It functions in stocks of all colors, forms a stable emulsion for use in latex, and shows minimum color change in latex foam rubber and rug backing when exposed to nitrogen dioxide.

Naugawhite in white natural rubber mold cured stock is said to be superior to the alkylated polyphenols and the syrenated phenols in these important characteristics: reduced lacquer staining, improved oxygen resistance, and improved heat protection. In air and ammonia cured footwear stocks it does not cause pinking, and it produces a minimum of discoloration in white or colored rubber articles. Naugatuck is a proper choice in white sidewall tires requiring carcass compounds which are free from discoloration and staining. It does not cause stain or discolor in white sidewall stocks by migration from the carcass. Also,

(Continued on page 327)

¹ American Cyanamid Co. trade marks.

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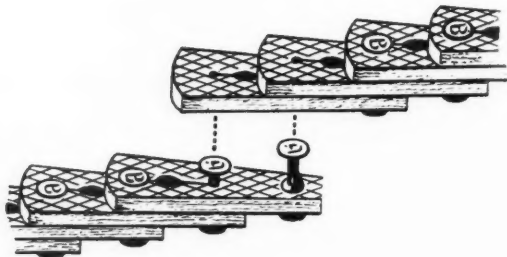


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NEW

PRODUCTS



Separating and rejoining Dixlink adjustable V-belts

Adjustable V-Belts

Sectional-type V-belts, designed for quick and easy installation on V-drives of any length, are now being produced by R. & J. Dick Co., Passaic, N. J. The adjustable-length V-belts are being made under the trade name Dixlink, for every size and kind of V-drives made by the company, which is a leader in the manufacture of industrial belting, chain drives, sheaves, shaft bearings, and other power transmission and conveying equipment.

Because of the adjustability feature, a single coil of Dixlink V-belt will often eliminate need of stocking scores of different lengths of V-belts of the same type. The Dixlink is made in special oil-resistant, heat-resistant, and fire-resistant grades, as well as in the regular grade for general use.

The Dixlink is designed particularly for fast and simple installation where an endless unit is not suitable owing either to structural restrictions or fixed centers. These belts are made to provide maximum power transmission efficiency for V-belt drives of from 1/2 to 1000 horsepower.

A booklet giving more detailed information on the V-belt is available from the company.

Nylon Custom Super-Cushion Tire

A new auto replacement tire said to be relaxed when inflated for service has been developed by The Goodyear Tire & Rubber Co., Akron, O. Called the Nylon Custom Super-Cushion, the tire is engineered to meet the requirements of today's more powerful automobiles and high-speed roadways.

The company's new tension-free shaping method profits the tire for the road, according to the company. It is said to relieve pull and stretch on a tire's cord, body, and tread, especially when the tire is mounted and inflated.

Shrinkage which normally takes place when a tire is removed from its mold is overcome by reshaping. The tire is held in shape under pressure until cool.

The tension-free shaping method, a wider and deeper tread and improved traction design enable the Nylon Custom Super-Cushion to take the pounding of heavy, high-powered automobiles during long, fast runs on the nation's super roads, it was reported. In tests determining rate of tread wear, Goodyear development engineers found in wear to smooth evaluations the tire lasts 26% longer than previous tires of its type.

The new tire is priced just slightly higher than regular tires. It is being distributed nationwide in a full range of 14- and 15-inch sizes, tubeless. Tube-type versions are available in 15-inch sizes, 6.70 through 8.20.

Trend, New Upholstery Material

United States Rubber Co., New York, N. Y., has developed a new type of upholstery material for home furniture which combines the lasting qualities of vinyl with the versatility of soft woven fabric. This new upholstery, called Trend, is a soft fabric reinforced and decorated with durable vinyl. It is said to be reasonably priced.

Trend's base is a soft woven fabric. With a new manufacturing process, this fabric is reinforced with a special protective vinyl coating that gives color fastness and resistance to soiling. The soft, modern, decorative vinyl pattern is then permanently fused to the fabric. Silvery metallic flitters accent the vinyl design.

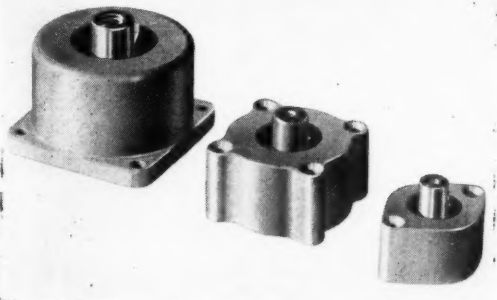
The new construction, it is also claimed, produces upholstery that is breathable, soft in feel, supple, easy to tailor, and long wearing. It wipes clean with a damp cloth.

Trend is being introduced by U. S. Rubber in ten colors—canary, meadow green, antique white, claret, mocha, cerulean, rock rose, glen green, black, and deep toast. It is 54 inches wide and will be sold in 30-yard rolls through distributors and direct to volume furniture manufacturers. It is made in the company's Stoughton, Wis., plant.

Industrial Raincoat

A light, but tough deluxe industrial raincoat, weighing about half as much as conventional lightweight raincoats, has been announced by B. F. Goodrich Industrial Products Co., Akron, O.

The 2½-pound coat is made of neoprene-coated nylon fabric to assure exceptional tear resistance. Colored a high-visibility yellow, the new raincoat is offered as a companion garment to the company's deluxe work suit and is available in standard sizes, 36 to 46 inclusive.



Lord BTR Mountings

Lord BTR Mountings

Lord Mfg. Co., Erie, Pa., has introduced a new series of vibration control mountings for the protection of airborne electronic equipment. They incorporate the company's new broad temperature range elastomer—BTR—which combines performance-proved elastomeric advantages with extreme environmental resistance.

BTR mountings provide excellent all-altitude vibration isolation of frequencies to 2,000 c.p.s. under 5G steady-state accelerations and transient shock conditions with no standing waves, distributed system responses, or bottoming. Broad temperature operation is possible since transmissibility and resonant frequency remain virtually constant from —65 to 300° F.

The BTR elastomer combines three functions: load carrying, damping, and snubbing. It resists oil and ozone, has high tensile strength, high tear resistance, and good flex life.

The new mountings are designed in three basic sizes—HTO, HT1, and HT2—for loads from three to 80 pounds per mounting. Specification MIL-C-172B mounting hole configurations provide maximum interchangeability in standard military equipment.

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TECHNICAL

BOOKS

BOOK REVIEWS

"Dangerous Properties of Industrial Materials." Edited by N. Irving Sax. Cloth covers, 7 $\frac{3}{16}$ by 10 $\frac{3}{16}$ inches, 1474 pages. Reinhold Publishing Corp., New York, N. Y. Price \$22.50.

This is a greatly improved and extended version of an earlier work by Sax entitled, "Handbook of Dangerous Materials." This later effort presents a compilation of data on the safe use and handling of nearly 9,000 industrial materials. Also included in this volume are sections covering, in condensed form, industrial toxicology, principles of ventilation control of toxic mists, fumes and dusts, air pollution, radiation hazards, reactor safeguards, and other related subjects. These discussions make this book a convenient and authoritative reference for industrial hygienists, safety engineers, or others who may be concerned or responsible for the occupational health and safety of industrial employees.

The increased industrial use of ionizing radiation sources has resulted in the listing of the commonly used radioisotopes and some of their nuclear properties in the general chemical section, in addition to the section covering radiation hazards and health physics.

The ventilation control section covers the basic concepts of general and exhaust ventilation, hood and exhaust system design, and specific exhaust requirements for the control of dusts generated by some of the more common industrial operations.

Dr. Leonard Goldwater, of Columbia University, has contributed a section on toxicology and has condensed this voluminous subject to a few pages of basic information on types of poisons, modes of entry, clinical laboratory tests with normal blood and urine levels, etc.

Those who found Sax's original Handbook a useful reference will find this latest effort keeping pace with present industrial trends and the increasing interest in occupational health. It is an excellent handbook for any industrial plant regardless of type or size.

JOHN C. LUMSDEN

"Solvent Extraction in Analytical Chemistry." By G. H. Morrison and H. Freiser. Cloth cover, 6 $\frac{3}{16}$ x 9 $\frac{5}{16}$ inches, 280 pages. John Wiley & Sons, Inc., New York, N. Y. Price \$6.75.

This book is a comprehensive discussion of solvent extraction processes and their uses in metal chemical separations.

The authors have divided their book into four sections for easy reference as follows: Part 1. Principles of Solvent Extraction; Part 2. Apparatus and General Techniques; Part 3. Extraction Systems; and Part 4. Separations.

The first part is a theoretical discussion of the general solvent extraction process and covers such topics as principles of solvent extraction, formation of metal complexes, distribution of the extractable species, chemical interactions in the organic phase, quantitative treatment of extraction equilibria, and kinetic factors in extraction.

The second section is devoted to extraction apparatus and the general techniques of solvent extraction. Both macro and micro extractors for batch, continuous, and countercurrent extractions are described.

Part 3 discusses in detail several ion association and chelate extraction systems.

The final portion of the book offers a selection "of detailed, 'how-to-do it'" procedures for the extraction of the elements.

Although primarily directed to the analytical chemist and his problems of performing chemical separations, this book should

be worthwhile reading for all chemists and chemical engineers. There are many instances where analytical separations have grown into large plant-scale operations.

NEW PUBLICATIONS

Publications of The Goodyear Tire & Rubber Co., chemical division, Akron, O. (Tech-Book Facts Bulletins):

"Goodyear Latex—Types and Properties." TBF 58-48. 4 pages. This replaces TBF 56-289.

"Pliolite Rubber Latex: Types and Properties." TBF 58-49. 2 pages. This replaces TBF 56-259.

"Pliolite Resin Latex: Types and Properties." TBF 58-50. 2 pages. This replaces TBF 57-136.

"Chemigum Latex—Types and Properties." TBF 58-51. 2 pages. This replaces TBF 57-100.

"Pliovic Latex 300: Types and Properties." TBF 58-52. 2 pages. This replaces TBF 56-121A.

"Compounding Study: Fillers in Chemigum N6B." TBF 57-365. 16 pages. This study was made to provide a quick preliminary reference for selecting a filler for a nitrile polymer application. In this study only one polymer and one cure system have been used. It shows the effect of each pigment on each physical property over the loading range normally used for that pigment. The pigments selected were used to cover the entire range of particle size and degree of structure of the carbon blacks as far as practical and from ultra-fine to coarse in the case of the non-blacks.

"Compound Recommendations for Specification AMS 3202E." TBF 58-15. 2 pages. This specification covers the properties of compounds used to make packings, bushings, grommets, and seals for use in extreme dry heat. Three Chemigum N7 compounds are formulated which meet the specification requirements for AMS 3202E. Physical properties and test data are included.

"Recommendations for Meeting Specification AMS 3212F." TBF 58-16. 2 pages. This specification covers the properties of compounds used to make gaskets, diaphragms, bushings, grommets, and sleeves requiring resistance to aromatic and non-aromatic fuels. Two Chemigum N7 formulations, their physical properties, and test data are given.

"Pliolite Latexes in Foam Rubber." TBF 57-333. 6 pages. This technical bulletin describes cellular rubbers, processing methods, and typical properties of Pliolite rubber latexes. The two synthetic latexes listed for use in foam rubber are Pliolite 2104 and Pliolite 2105. The first latex is the product of polymerized butadiene; while the other is a 70/30 copolymer of butadiene and styrene. A third copolymer, Pliolite Latex 151, is considered. It is an aqueous dispersion of a reinforcing type styrene-butadiene copolymer.

"Recommendations for Meeting Specification ASTM D735 Class SB 410BE₁E₂F₁." TBF 58-35. 2 pages. This data sheet presents a study where Chemigum N6 is compounded both with and without Plioflex 1502 to meet the specification requirements for SB 410BE₁E₂F₁, an automotive elastomer compound having low volume swell in low aniline point oils.

"A New Method and Equipment to Densify Fine Powders." IPD-8-8. J. M. Huber Corp., Borger, Tex. 2 pages. This technical bulletin describes a new method and apparatus for deaerating and compacting, or densifying, fine powdered materials which has been developed by the company. Operating and maintenance costs are included.

"Hycar 1072 Is Resistant to Atmospheric Ozone." Hycar Technical Newsletter, Vol. VII, No. 1. B. F. Goodrich Chemical Co., Cleveland, O. 16 pages. Compounds of Hycar 1072 have been tested and proven to be superior to standard nitrile rubber in ozone resistance. This ozone-resistant quality, combined with the oil resistance of a medium-high acrylonitrile content rubber, good flexibility, high strength, and exceptional resistance to abrasion and oxidation, suggests its applications, such as electrical jackets, extruded fuel line hose, gaskets, and fabric coatings. Evaluation of cements for the adhesion of cured Hycar 4021 polyacrylic rubber to itself is presented. Evaluation of carbon blacks in Hycar 4021, soft and hard Hycar roll compounds, and specification compounding are other topics of the study.

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Odor.....Faint
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"Report on Inhalation Tests of Hi-Sil 233." Hi-Sil Bulletin No. 17. Columbia-Southern Chemical Corp., Pittsburgh, Pa. 2 pages. This is a brief summary of the effects of inhalation of HiSil 233 dust. G. W. H. Schepers, who conducted the tests, found from the evidence of the tests, that the effects of this relatively innocuous dust were significantly distinguished from those of the more injurious group of particulate submicron amorphous silicas.

"Study of Process Oils as Butyl Plasticizers." Bulletin 103-1. Thiokol Chemical Corp. Trenton, N. J. 11 pages. This study evaluates various process oils as extenders and plasticizers in butyl rubber. Graphical data depict the results of increasing levels of process oils and the effects they have on the physical properties of the butyl compounds. Six process oils were evaluated.

"Moisture Adsorption of Carbon Blacks," No. GD-20. T. D. Bolt, Godfrey L. Cabot, Inc., Cambridge, Mass. 4 pages. This study covers the same subject as the paper published in RUBBER WORLD, March and April, 1958. This work explains that the moisture adsorption properties of commercial carbon blacks are of direct practical interest in many product applications such as rubber and plastics. It details these properties for many grades of blacks.

"Off-the-Road Tires Handbook." B. F. Goodrich Tire Co., Akron, O. 52 pages. How equipment operators and owners can get maximum service out of off-the-road tires is described in this handbook. Four factors, load, inflation, operating conditions, and tire care, all within control of the equipment operator or owner, are discussed. The booklet also describes the company's line of off-the-road tires and carries data on load and inflation, weights and measures, tire specifications for 1957 motor graders, self-propelled scrapers, and tractor-drawn scrapers plus valve and rim information.

Publications of The Rubber Manufacturers Association, Inc., New York, N. Y.:

The Tire Accessories and Repair Materials Committee has published a series of seven bulletins concerning common causes of retread failures. Each of these explains and illustrates the reasons for particular types of premature failures in retreaded tires. The title and a brief description of each bulletin follow.

"Voids in the Shoulder Area (Channelling)." Bulletin No. 1. 2 pages. This sheet lists the causes for the development of voids in the shoulder area of retreaded tires; the main causes are incorrect buffing, incorrect building, and incorrect molding or curing procedures. Remedies are given for the correction of this condition.

"Correct Tire Buffing." Bulletin No. 2. 1 page. This sheet outlines 13 steps to take for correctly buffing a tire to be re-capped.

"Poor Molding." Bulletin No. 3. 2 pages. This bulletin on the subject of poor molding covers the improper molding of tread rubber in the matrix design which results in lightness, light shoulders, and design non-fill. Ten suggestions for improved molding are listed.

"Radial Cracking." Bulletin No. 4. 2 pages. This sheet gives illustrations and causes of radial cracking. Radial cracking in the retread sidewall can be caused by underinflation, faulty casing inspection, faulty buffing, faulty build-up, or faulty curing.

"Tread Tearing." Bulletin No. 5. 1 page. Tread tearing of a retreaded tire can be caused by matrix design, insufficient under-tread, insufficient mold lubrication, improper removal from matrix, overcure, or rough or dirty matrices.

"Separation." Bulletin No. 6. 2 pages. Separation between original carcass rubber and new retread may be caused by poor shop practice during buffing, building, or cure. Specific examples of faulty shop practice are given for the three procedures.

"Groove Cracking." Bulletin No. 7. 1 page. The causes of groove cracking are listed, and steps to prevent this phenomenon are included.

"Price List—January 1, 1958," Borden Chemical Co., monomer-polymer laboratories, Philadelphia, Pa. This 1958 catalog lists more than 500 monomers and polymers including many new cross-linking agents, monomers for polyelectrolytes, and substituted ethylenimines.

"Effects of Shear Rates, Temperature, and Time on the Viscosity of Plastisols." Firestone Plastics Co., Pottstown, Pa. 32 pages. The aim of this study on the viscosity of plastisols is to aid the compounder by providing relative data on (1) the viscosity-temperature characteristics of many plasticizer systems, (2) the viscosity of these systems at low, medium, and high shear rates, and (3) the viscosity stability of these systems after one-week aging at room temperatures. Plasticizers reported on include phthalates, phosphates, adipates, epoxies, and polymeric, as well as secondary and special primary plasticizers.

"Hydraulic Fundamentals and Industrial Hydraulic Oils." Sun Oil Co., Philadelphia, Pa. 44 pages. This revised booklet is a practical introduction to the principle of hydraulic systems, with illustrated explanations of the most important types of valves, pumps, motors, torque converters, and accessories. An explanation of important oil characteristics is followed by sections on oil selection and trouble-shooting.

"Directory of British Rubber Manufacturers and Products." Federation of British Rubber & Allied Manufacturers, London, England. 202 pages. This 1958 guide to the British rubber manufacturing industry is divided into four sections, which include an index of manufacturers, an index of products, a section of general advertisements, and the tire industry section, and advertisements. The section on products is also keyed in French, Spanish and German.

"Adhesives, Sealants, Paints, and Coatings Listed According to Government Specifications." Magic Chemical Co., Brockton, Mass. 11 pages. This catalog is useful to all purchasing and procurement officials of companies handling government contracts, or who need products conforming to government specifications. The catalog, the results of a 30-year study, is divided into three sections, listing government specifications number and by title and the corresponding Magic Chemical Co. product number.

"Glass and Ceramics, Rubber Industries," National Safety Council, Chicago, Ill. 36 pages. This booklet is a record of sessions held at the 1957 National Safety Congress by the Glass and Ceramics and the Rubber sections. These sections give guidance in the preparation of a great variety of technical and educational material useful in the day-to-day safety programs of glass and ceramics, and rubber companies.

"The Tire & Rim Association—1958 Year Book." The Tire & Rim Association, Inc., Akron, O. 184 pages. This year book gives specifications for tires, rims, valves, etc., covering such sections as passenger cars, truck-bus, off-the-road, agricultural, industrial, valve, and aircraft. Each section contains engineering drawings and tables.

Naugawhite Antioxidant

(Continued from page 321)

excellent hot tensile properties, heat and oxygen aging resistance, and lower heat buildup are imparted by Naugawhite to carcass compounds, it is further claimed.

Naugawhite is said to offer good antioxidant protection to nitrile rubbers such as Paracril. The non-discoloring non-staining characteristics of this new material together with its excellent antioxidant protective action make it particularly adapted to use in latex compounding.

A technical bulletin describing its properties, its use in dry rubber applications and in latex applications, and various formulations is available from the company.

MARKET

REVIEWS

Natural Rubber

During the March 16-April 15 period the New York natural rubber market was singularly quiet, though perhaps a little steadier than London and Singapore markets. A little more factory interest has been reported, but the difficult position of the automobile industry still overhangs the market.

The two main influences on the rubber situation are still at work. The fighting in Indonesia has had some effect in the movement of rubber from that country, but nevertheless early shipment rubber from the port of Belawan is still being offered, and in the main the markets are not disrupted to the extent that one would suppose.

The other influence, the economic situation in the United States, still does not present too encouraging a picture. It should be noted, however, that the past statistics do not necessarily indicate the immediate trend. Steps being taken by government to combat the recession should be helpful. Recently the Army placed contracts for military lorries and trailers; the contracts were awarded to a great many manufacturers with the object of spreading the effect as much as possible. Military spending of this type is being accelerated with the idea that it will increase industrial activity and encourage more spending at both the industrial and the consumer level.

March sales, on the New York Commodity Exchange, amounted to 12,700 tons, compared with 12,220 tons for February Contract. There were 21 trading days in March and 21 during the March 16-April 15 period.

REX CONTRACT

| | Mar. 21 | Mar. 28 | Apr. 3 | Apr. 11 |
|-----------------------------|------------|------------|-----------|------------|
| 1958 | | | | |
| Mar. | 27.00 | 26.56 | | |
| May. | 27.34 | 26.56 | 26.45 | 26.90 |
| July. | 27.34 | 26.56 | 26.50 | 26.90 |
| Sept. | 27.38 | 26.56 | 26.56 | 26.90 |
| Nov. | 27.35 | 26.56 | 26.50 | 26.85 |
| 1959 | | | | |
| Jan. | 27.35 | 26.56 | 26.55 | 26.85 |
| Mar. | 27.35 | 26.56 | 26.60 | 26.85 |
| May. | | | 26.60 | 26.85 |
| Total weekly sales, tons | 3,710 | 1,990 | 790 | 1,270 |

On the physical market, RSS #1, according to the Rubber Trade Association of New York, averaged 26.77¢ per pound for the March 16-April 15 period. Average March sellers' prices

for representative grades were: RSS #3, 24.53¢; #3 Amber Blankets, 23.39¢; and Flat Bark, 20.10¢.

NEW YORK OUTSIDE MARKET

| | Mar. 21 | Mar. 28 | Apr. 3 | Apr. 11 |
|-----------------------|------------|------------|-----------|------------|
| RSS #1 | 27.25 | 26.50 | 26.63 | 26.88 |
| 2 | 26.00 | 26.50 | 25.50 | 25.75 |
| 3 | 24.75 | 24.25 | 24.25 | 24.50 |
| Pale Crepe | | | | |
| #1 Thick | 28.50 | 27.75 | 27.75 | 28.00 |
| Thin | 28.00 | 28.25 | 28.25 | 28.50 |
| #3 Amber Blankets | 23.50 | 23.13 | 23.00 | 22.88 |
| Thin Brown Crepe | 23.00 | 22.88 | 22.88 | 22.50 |
| Standard Bark Flat | 20.13 | 20.00 | 19.88 | 19.88 |

Synthetic Rubber

Consumption of all types of synthetic rubber in March amounted to 65,637 long tons, compared with 64,230 tons in February, according to the monthly report of The Rubber Manufacturers Association, Inc. By types this consumption was divided as follows: SBR, 54,643 tons, against 52,962 in February; neoprene, 4,751, against 5,045; butyl, 4,328, against 4,255; and nitrile, 1,915, against 1,968. Synthetic rubber use in this country is therefore holding its own although first-quarter 1958 consumption at 202,492 tons is considerably below that for the first quarter of 1957, when 243,505 tons were used.

Production of synthetic rubber in March totaled 83,610 tons, compared with 81,755 tons in February. By types in March, compared with February output, synthetic rubber production was as follows: SBR, 69,210, against 66,402; neoprene, 7,672, against 8,200; butyl, 4,698, against 4,996; and nitrile, 2,030, against 2,157.

Exports of synthetic rubber increased from 15,600 tons in February to 18,650 tons in March, with the major part of this increase due to SBR, which rose to 14,350 tons from the 11,500 tons exported in February.

The general consensus of opinion appears to be that synthetic rubber consumption will hold up reasonably well during May and June. The summer vacation period will reduce consumption, but the latter part of the year should show considerable improvement.

Latex

An improved interest has been reasonably well maintained during the March 15-April 15 period, and the resultant offtake appears momentarily to have been about in line with current offerings for nearby shipment.

On the other hand the effect of wintering in Malaya, resulting in lower production in February and March, has not been felt in the market as it has more or less been offset by contraction in the volume of demand. Although the present price level would appear to be favorable from a consumer's point of view, the uncertain business outlook undoubtedly discourages many buyers from entering into forward engagements as long as the supply position remains easy. Such a situation, according to one source, is likely to lead to complacency which, however, might easily be upset should there be any interference with the regular supply of latex from Indonesia.

Prices for ASTM Centrifuged Concentrated natural latex, in tank-car quantities, f.o.b., rail tank car, ran about 34.70¢ per pound solids. Synthetic latices prices were 22.5 to 31.2¢ for SBR; 37 to 55¢ for neoprene; and 46 to 65¢ per pound for nitrile types.

Final January and preliminary February domestic statistics for all latices were reported by the United States Department of Commerce as given in the tabulation below:

(All Figures in Long Tons, Dry Weight)

| Type of Latex | Pro- duc- tion | Im- ports | Con- sump- tion | Month- End Stocks |
|------------------|----------------------|--------------|-----------------------|-------------------------|
| Natural | | | | |
| Jan. | 0 | | 6,380 | 14,178 |
| Feb. | 0 | | 5,380 | 15,506 |
| SBR | | | | |
| Jan. | 5,998 | — | 5,438 | 8,222 |
| Feb. | 3,852 | — | 4,475 | 7,992 |
| Neoprene | | | | |
| Jan. | 788 | 0 | 806 | 1,190 |
| Feb. | 765 | 0 | 640 | 1,251 |
| Nitrile | | | | |
| Jan. | 785 | 0 | 683 | 2,062 |
| Feb. | 671 | 0 | 806 | 2,297 |

Scrap Rubber

It was reported that there were no new developments in the scrap rubber market recently, at least not any that would lend encouragement. The Nauga-



CYANAMID

RUBBER

Chem Lines

NO. 16 OF A SERIES

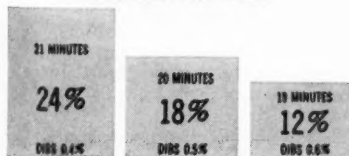
Published by AMERICAN CYANAMID COMPANY, Rubber Chemicals Department, Bound Brook, New Jersey

DIBS—An Outstanding Delayed Action Accelerator with SAF Blacks

High processing temperatures and fast curing rates create problems in the use of the newer reinforcing furnace blacks. Maximum delayed action is required if the necessary high degree of processing safety is to be achieved.

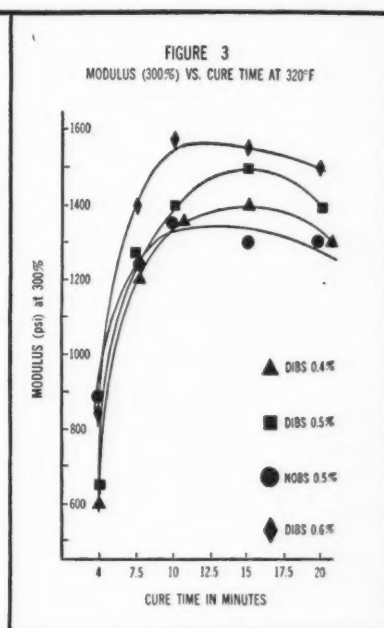
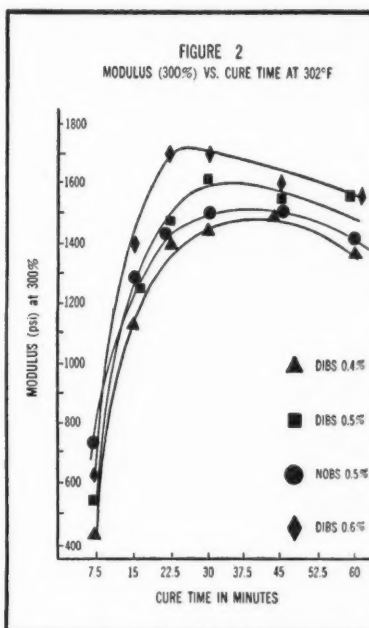
DIBS®, one of Cyanamid's delayed action accelerators, has been developed by the Rubber Chemicals Department specifically to meet this problem. Used with ISAF and SAF furnace blacks, it shows outstanding processing safety and, at curing temperatures of 280° F and higher, is a very active accelerator. In the absence of these super-abrasion blacks, however, maximum processing safety and a high degree of delayed action are not as critical, and the use of Cyanamid's accelerators NOBS* No. 1 or NOBS Special is suggested. For the purpose of this article, the performance of DIBS in the presence of SAF black is compared with that of NOBS Special.

FIGURE 1
PERCENTAGE INCREASE IN DELAYED ACTION
(Reference: 0.5% NOBS SPECIAL)
MOONEY SCORCH VALUES AT 268°F



BASE FORMULA

| | |
|--------------------------------|----------|
| Smoked Sheets | 100 |
| SAF Black | 50 |
| Zinc Oxide | 5 |
| Stearic Acid | 2 |
| Pine Tar | 3 |
| Phenyl Beta Naphthylamine..... | 1 |
| B-L-E 25 | 1 |
| Sulfur | 2.25 |
| Accelerator | As noted |



In Mooney Scorch tests carried out at 268° F, DIBS in ratios of 0.6% to 0.4% gives approximately 12% to 24% more delayed action than 0.5% NOBS Special. Delayed action increases as the DIBS accelerator ratio decreases. For example, 0.6% DIBS gives a scorch time of 19 minutes, while 0.4% shows an increase to 21 minutes. The Mooney Scorch time for 0.5% NOBS Special is 17 minutes.

The effect of DIBS and NOBS Special on modulus values is shown in Figures 2 and 3. At a curing temperature of 302° F, 0.4% DIBS shows slightly lower modulus values than 0.5% NOBS Special throughout the time range; in ratios of 0.5% and 0.6%, however, DIBS consistently shows higher values. The effect

of raising the curing temperature to 320° F is shown in Figure 3, and it becomes apparent that at the higher temperature less DIBS is needed compared with NOBS Special to provide the same modulus values. At this temperature, DIBS, even in its lowest ratio of 0.4%, shows higher modulus values than 0.5% NOBS. These results clearly indicate the superiority of DIBS at high curing temperatures when SAF blacks are present.

Full technical information on DIBS Delayed Action Accelerator is given in Rubber Chemicals Technical Bulletin No. 850. Ask your Cyanamid Representative for a copy, or write direct to American Cyanamid Company, Rubber Chemicals Department, Bound Brook, New Jersey.

*Trademark

Market Reviews

tuck reclaimer was operating, but taking in only butyl tubes and no mixed tires. The Buffalo reclaimer, however, was taking mixed tires at \$11.00. The eastern price for mixed tires, consequently, was quoted at \$11.00 and applicable only on shipments to Buffalo.

Synthetic butyl tubes in the East moved at 3.50¢ and at 3.625¢ in the Midwest. Black passenger tubes and red passenger were at 6.25¢, both at eastern and midwestern points.

There were no signs of any improvements in the scrap rubber market, and trade factors were of the opinion that current depressed conditions would continue, particularly in view of the general business recession.

| | Eastern Points Per Net Ton | Akron, O. Per Net Ton |
|----------------------|----------------------------------|-----------------------------|
| Mixed auto tires | \$11.00 | \$12.00 |
| S. A. G. truck tires | nom. | 15.50 |
| Peeling, No. 1 | nom. | 23.00 |
| 2 | nom. | 20.00 |
| 3 | nom. | 15.50 |
| Tire buffings | nom. | nom. |
| | (¢ per Lb.) | |
| Auto tubes, mixed | 2.50 | 2.75 |
| Black | 6.25 | 6.25 |
| Red | 6.25 | 6.25 |
| Butyl | 3.50 | 3.625 |

Reclaimed Rubber

The period between March 16-April 15 continued to be quite slow in the reclaimed rubber business although, according to one source, there have been some signs of pickup since the first of April. It was expected to be a better month than March.

According to The Rubber Manufacturers Association, Inc., report, March production of reclaimed rubber reached 20,500 tons; while consumption was 19,750 long tons.

RECLAIMED RUBBER PRICES

| | |
|---|--------|
| Whole tire, first line | \$0.11 |
| Third line | .1025 |
| Inner tube, black | .16 |
| Red | .21 |
| Butyl | .14 |
| Light carcass | .22 |
| Mechanical, light-colored, medium gravity | .155 |
| Black, medium gravity | .085 |

The above list includes those items or classes only that determine the price basis of all derivative reclaim grades. Every manufacturer produces a variety of special reclaims in each general group separately featuring characteristic properties of quality, workability, and gravity, at special prices.

Industrial Fabrics

Industrial textile producers, experiencing a steady decline in new orders and backlogs in the last year, have trimmed their operations considerably for what is expected to be a more extended let-down in demand.

As buying by auto and rubber products manufacturers, machine tool producers, aluminum companies (the latter two, mostly wire cloth users), and other users of industrial textiles fell off quarter by quarter, production schedules were cut back correspondingly by weaving mills, tire yarn producers, vinyl plastic, coated fabric, and other plants.

Any upturn in industrial fabrics consequently will hinge closely on what happens in the months ahead in the nation's basic industries, especially the automotive industry. Thus, on the basis of most indicators, the near-term outlook does not appear too promising for most industrial textiles.

Army ducks and other awning fabrics, which have not experienced anywhere near so sharp a decline as evident in the heavy industry sector, may enjoy a moderate pickup. In vinyl coated fabrics, improved buying for some end uses also is likely.

INDUSTRIAL FABRICS

Drills

| | | |
|------------------|-----|-------------|
| 59-inch 1.85 yd. | yd. | \$0.335/.34 |
| 2.25-yd. | | .285/.29 |

Ducks

| | | |
|--------------------------|-----|------|
| 38-inch 1.78-yd. S.F. | yd. | nom. |
| 2.00-yd. D.F. | | .30 |
| 51.5-inch, 1.35-yd. S.F. | yd. | |
| Hose and belting | | .63 |

Osnaburgs

| | | |
|------------------|-----|-------|
| 40-inch 2.11-yd. | yd. | .2275 |
| 3.65-yd. | | .1525 |

Raincoat Fabrics

| | | |
|-----------------------------|-----|-------|
| Printcloth, 38½-in., 64-60, | | |
| 5.35-yd. | yd. | .1325 |
| 6.25-yd. | | .1165 |
| Sheeting, 48-inch, 4.17-yd. | | .20 |
| 52-inch, 3.85-yd. | | .2275 |

Chefer Fabrics

| | | |
|-----------------------|-----|-------|
| 14.40-oz./sq. yd. Pl. | yd. | .73 |
| 11.65-oz./sq. yd. S. | | .61 |
| 10.80-oz./sq. yd. S. | | .6575 |
| 8.9-oz./sq. yd. S. | | .67 |

Other Fabrics

| | | |
|-------------------------------|-----|----------|
| Headlining, 59-in., 1.65-yd., | | |
| 2-ply | yd. | .41 |
| 64-inch, 1.25-yd., 2-ply | | .39 |
| Sateens, 58-inch, 1.32-yd. | | .52/.525 |
| 58-inch, 1.21-yd. | | .5675 |

Rayon

Total packaged production of rayon and acetate filament yarn during March was 54,700,000 pounds, consisting of 23,400,000 pounds of high-tenacity rayon yarn and 31,300,000 pounds of regular-tenacity rayon yarn. For February production had been: total 49,700,000 pounds, including regular-tenacity rayon yarn, 26,500,000 pounds; high-tenacity rayon yarn, 23,200,000.

Filament yarn shipments to domestic consumers for March amounted to 55,300,000 pounds, of which 23,800,000 pounds were high-tenacity rayon yarn. and 31,500,000 were regular-tenacity rayon yarn. February shipments had been: total, 49,700,000 pounds; high - tenacity, 21,500,000

pounds; regular-tenacity, 28,200,000 pounds.

Stocks on March 31 totaled 69,400,000 pounds, made up of 17,200,000 pounds of high-tenacity rayon yarn and 52,200,000 pounds of regular-tenacity rayon yarn. End-of-February stocks had been: total, 70,000,000 pounds; high-tenacity rayon yarn, 17,600,000 pounds; regular-tenacity yarn, 52,400,000 pounds.

RAYON PRICES

Tire Fabrics

| | | |
|------------|--|-----------------|
| 1100/490/2 | | \$0.69 / \$0.73 |
| 1650/908/2 | | .63 / .725 |
| 2200/980/2 | | .625/ .655 |

Tire Yarns

| | | |
|----------------|--|----------|
| High-Tenacity | | |
| 1100/ 490, 980 | | .50/ .64 |
| 1100/ 490 | | .59/ .63 |
| 1150/ 490, 980 | | .59/ .63 |
| 1165/ 480 | | .59/ .65 |
| 1230/ 490 | | .59/ .63 |
| 1650/ 720 | | .55/ .58 |
| 1650/ 980 | | .55/ .58 |
| 1875/ 980 | | .55/ .58 |
| 2200/ 960 | | .54/ .57 |
| 2200/ 980 | | .54/ .57 |
| 2200/1466 | | .64 |
| 4400/2934 | | .60 |

Super-High Tenacity

| | | |
|-----------|--|-----|
| 1650/ 720 | | .58 |
| 1900/ 720 | | .58 |

Utacide Fatty Acid

Utacide is the name of a new form of fatty acid for rubber that has been put on the market by a French firm and is said to be much more effective than stearic acid in most applications. This product, which includes in addition to pure lauric acid, a mixture of acids with more or less long carbon chains, is a cream-colored vaseline-like mass melting completely at 30° C. At this temperature its density is 0.892; at 15° C. it is 0.902. Its melting point is between 25 and 29° C.; acid number, 245-265; saponification number, 248-270; and iodine number, 1-14. It is claimed that in practically all cases stearic acid can be advantageously replaced by a much smaller amount of Utacide (30-50% less), giving a substantial direct saving; furthermore, processing is easier than with stearic acid; the effect on scorch time is more favorable; dispersion of fillers, particularly carbon black, is improved; and blooming is absent.

This fatty acid is especially recommended for use in high carbon mixes, as for conveyor and V-belts, retread material, hose; for mixes heavily loaded with mineral fillers, for matting, heels and soles, some footwear compounds, various mechanical goods; unvulcanized mixes that must be stored for prolonged periods; and very plastic mixes intended for spongy materials and for solutions.

HOGGSON

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For Rubber Testing and Production



"DUMBBELL" Test Strip Die D412(51T)



BENCH MARKER

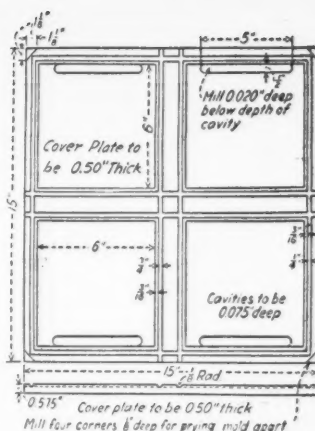


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D15-41



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| | | |
|------------------------------------|---------|--------|
| 11-80, 100, 200, 112-3 Triols, lb. | \$0.255 | |
| 11-300.....lb. | .265 | |
| 11-400.....lb. | .325 | |
| Acrylonitrile.....lb. | .27 | |
| Butadiene.....lb. | .15 | |
| Dow Styrene N99, H99.....lb. | .205 | |
| RG.....lb. | .17 | |
| Vinyltoluene.....lb. | .17 | |
| Hylene M.....lb. | 3.50 | \$5.00 |
| M-50.....lb. | 1.90 | 3.40 |
| T.....lb. | 1.10 | 2.65 |
| TM.....lb. | .95 | 2.50 |
| -65.....lb. | 1.00 | 2.55 |
| Isobutylene.....lb. | .38 | |
| Isoprene.....lb. | .25 | |
| Monomer MG-1.....lb. | 1.00 | 1.25 |
| Mondur-C.....lb. | 1.05 | |
| S.....lb. | .85 | |
| Multiron R-2.....lb. | .54 | |
| P200.....lb. | .23 | |
| Rohm & Haas ethyl acrylate/lb. | .34 | .36 |
| Glacial methacrylic acid.....lb. | .45 | .47 |
| Methyl acrylate.....lb. | .37 | .39 |
| Methacrylate.....lb. | .29 | .31 |

Shortstops

| | | |
|-----------------------|------|------|
| DDM.....lb. | .88 | .915 |
| Mercaptan 174.....lb. | .38 | .50 |
| Sharstop.....lb. | .33 | .37 |
| 268.....lb. | .52 | .53 |
| Tecquinol.....lb. | .825 | .845 |
| Thiostop K.....lb. | .50 | .53 |
| N.....lb. | .38 | .47 |
| Vulnapol KM.....lb. | .52 | .53 |
| NM.....lb. | .38 | .42 |

Acrylic Types

| | | |
|--------------------|------|---|
| Hycar 4021.....lb. | 1.35 | * |
| 4501.....lb. | .81 | * |

Fluorocarbon Types

| | | |
|-------------------------|-------|-------|
| Kel-F Elastomer.....lb. | 15.00 | 16.00 |
|-------------------------|-------|-------|

Isobutylene Types

| | | |
|--|------|-------|
| Deenax.....lb. | .94 | 1.05 |
| Enjay Butyl 035, 150, 215, 217, 218, 325.....lb. | .23 | |
| 065, 165, 265, 267, 268, 365.....lb. | .24 | |
| Hycar 2202.....lb. | .65 | * |
| Polyar Butyl 100, 200, 300, 400.....lb. | .245 | * |
| 101.....lb. | .23 | .2775 |
| 301.....lb. | .255 | * |
| Vistanex.....lb. | .45 | * |

Neoprene

| | | |
|------------------------------|-----|---|
| Neoprene Type AC, CG.....lb. | .55 | * |
| GN, GN-A, WX.....lb. | .41 | |
| GRT, S.....lb. | .42 | * |
| KNR.....lb. | .75 | * |
| W, WHV.....lb. | .39 | * |
| WRT.....lb. | .45 | * |

Latexes

| | | |
|-----------------------------------|-----|---|
| Neoprene Latex 571, 842-A.....lb. | .37 | * |
| 572.....lb. | .39 | * |
| 60, 601-A.....lb. | .40 | * |
| 635.....lb. | .41 | * |
| 650.....lb. | .42 | * |
| 735, 736.....lb. | .38 | * |
| 750.....lb. | .39 | * |
| 950.....lb. | .47 | * |

Nitrile Types

| | | |
|-------------------------------------|------|---|
| Butaprene NAA.....lb. | .54 | * |
| NF.....lb. | .49 | * |
| NL.....lb. | .50 | * |
| NXM.....lb. | .58 | * |
| Chemigum N1NS.....lb. | .64 | * |
| N3NS, N5.....lb. | .58 | * |
| N6, N-6B, N7, N8.....lb. | .58 | * |
| Hycar 1001, 1041.....lb. | .50 | * |
| 1002, 1042, 1043, 1312.....lb. | .60 | * |
| 1014.....lb. | .64 | * |
| 1072.....lb. | .64 | * |
| 1411.....lb. | .62 | * |
| 1432.....lb. | .59 | * |
| 1441.....lb. | .64 | * |
| Paracril AJ.....lb. | .485 | * |
| B, BJ, BJLT, BLT.....lb. | .51 | * |
| C, CLT.....lb. | .59 | * |
| CV.....lb. | .60 | * |
| D.....lb. | .65 | * |
| 18-80.....lb. | .60 | * |
| Polyar Krynac 800, 802, 803.....lb. | .50 | * |
| 801.....lb. | .58 | * |

Latexes

| | | |
|---------------------------------------|-----|---|
| Butaprene N-300.....lb. | .46 | b |
| N-400, N-401.....lb. | .54 | b |
| Chemigum 200.....lb. | .49 | b |
| 235 CHS, 236.....lb. | .54 | b |
| 245 B, 245 CHS, 246, 247, 248.....lb. | .46 | b |
| Hycar 1512, 1552, 1562, 1577.....lb. | .46 | b |
| 1551, 1561, 1571.....lb. | .54 | b |
| 1852.....lb. | .46 | b |

| | | |
|---------------------------|--------|---|
| Nitrex 2612, 2614.....lb. | \$0.46 | * |
| 2615.....lb. | .51 | * |

Polyethylene Type

| | | |
|--------------------|-----|--|
| Hypalon 20.....lb. | .70 | |
|--------------------|-----|--|

Polysulfide Types

| | | |
|---|------|---|
| Thiokol LP-2, -3, -31, -32, -33.....lb. | .96 | * |
| -8, -38.....lb. | 1.25 | * |
| PR-1.....lb. | .95 | * |
| Type-A.....lb. | .47 | * |
| FA.....lb. | .69 | * |
| ST.....lb. | 1.00 | * |

Latexes

| | | |
|---------------------------------|-----|---|
| Thiokol Latex (dry wt.).....lb. | .85 | * |
| Type MF.....lb. | .70 | * |
| MX.....lb. | .92 | * |
| WD-2.....lb. | .95 | * |
| -5.....lb. | .95 | * |
| -6, -7.....lb. | .70 | * |

Silicone Types

| | | |
|--|--------|------|
| GE (compounded).....lb. | \$2.25 | 4.10 |
| Silicone gum (not com- pounded).....lb. | 3.85 | 4.90 |
| Silastic (compounded).....lb. | 3.25 | 3.65 |
| (Partly compounded).....lb. | 3.25 | 4.35 |
| (Uncompounded).....lb. | 3.85 | 4.50 |
| Union Carbide (compounds).....lb. | 2.35 | 3.20 |
| (Gums).....lb. | 3.85 | 4.25 |

Styrene Types†

Hot SBR†

| | | |
|---|-------|---|
| Ameripol 1000, 1001, 1006, 1007.....lb. | .241 | c |
| 1002.....lb. | .2435 | * |
| 1009.....lb. | .2475 | * |
| 1011.....lb. | .2550 | * |
| 1012.....lb. | .2425 | * |
| 1013.....lb. | .25 | * |
| ASRC 1000, 1001, 1004, 1006.....lb. | .241 | * |
| 1018.....lb. | .270 | * |
| 1019.....lb. | .265 | * |
| FR-S 1000, 1001, 1004, 1006.....lb. | .241 | * |
| 1009.....lb. | .2475 | * |
| 1010.....lb. | .26 | * |
| 1012.....lb. | .2425 | * |
| 1013.....lb. | .25 | * |
| 1014.....lb. | .281 | * |
| 1015.....lb. | .291 | * |
| Naugapal 1016, 1019.....lb. | .265 | * |
| 1018.....lb. | .27 | * |
| 1021.....lb. | .30 | * |
| 1022.....lb. | .28 | * |
| 1023.....lb. | .285 | * |

* Prices are per pound carload or tank-car dry weight unless otherwise specified.

† Freight extra.

‡ Minimum freight allowed.

§ Freight prepaid.

§SBR—Styrene-butadiene rubber.

§BR—Butadiene rubber.

† Listed below are the new SBR type synthetic rubbers and latexes trade names and the chief sales offices of their producers or distributors.

| | |
|-----------------|---|
| Ameripol | —Goodrich-Gulf Chemicals, Inc., 3135 Euclid Ave., Cleveland 15, O. |
| ASRC | —American Synthetic Rubber Corp., 500 Fifth Ave., New York 36, N. Y. |
| Baytown | —United Rubber & Chemical Co., Baytown, Tex. (producer); United Carbon Co., Inc., Charleston 27, W. Va. (distributor). |
| Butaprene, FR-S | —Firestone Tire & Rubber Co., Synthetic Rubber Division, 381 Wilbeth Rd., Akron 1, O. |
| Copo | —Copolymer Rubber & Chemical Corp., P. O. Box 2595, Baton Rouge 1, La. |
| Naugapal | —Naugetuck Chemical Division, United States Rubber Co., Naugetuck, Conn. |
| Philprene | —Phillips Chemical Co., Rubber Chemicals Division, 318 Water St., Akron 8, O. |
| Plioflex | —Goodyear Tire & Rubber Co., Chemical Division, Akron 16, O. |
| Pliolite Latex | —Goodyear Tire & Rubber Co., Chemical Division, Also distributed by General Latex & Chemical Corp., 666 Main St., Cambridge 39, Mass. |
| Polysar | —Polymer Corp., Ltd., Sarnia, Ont., Canada (producer); H. Muehlstein & Co., Inc., 60 E. 42nd St., New York 17, N. Y. (distributor). |
| S- | —Shell Chemical Corp., Synthetic Rubber Sales Division, 50 W. 50th St., New York 20, N. Y. |
| Synpol | —Texas-U. S. Chemical Co., Port Neches, Tex. (producer); Naugetuck Chemical (distributor). |

| | | |
|---|---------|---|
| Philprene 1000, 1001, 1006.....lb. | \$0.241 | b |
| 1009.....lb. | .2475 | b |
| 1010.....lb. | .26 | b |
| 1018.....lb. | .27 | b |
| 1019.....lb. | .265 | b |
| Plioflex 1006.....lb. | .241 | b |
| Polyar S, S-50.....lb. | .241 | b |
| S-X-371.....lb. | .255 | b |
| S-1000, -1001, -1006, -1013.....lb. | .23 | b |
| -1002, -1011.....lb. | .2325 | b |
| Synpol 1000, 1001, 1006, 1007, 1001.....lb. | .241 | b |
| 1002.....lb. | .2435 | b |
| 1012.....lb. | .2425 | b |
| 1009.....lb. | .2475 | b |
| 1013.....lb. | .25 | b |

Hot SBR Black Masterbatch

| | | |
|------------------------|------|---|
| Philprene 1100.....lb. | .194 | |
| 1104.....lb. | .190 | b |
| S-1100.....lb. | .185 | b |

Cold SBR

| | | |
|-----------------------------------|-------|---|
| Ameripol 1500, 1501, 1502.....lb. | .241 | |
| ASRC 1500, 1502.....lb. | .241 | * |
| 1503.....lb. | .2625 | * |
| Copo 1500, 1502.....lb. | .241 | * |
| 1505.....lb. | .261 | * |
| FR-S 1500, 1502.....lb. | .241 | * |
| Naugapal 1503.....lb. | .2625 | * |
| Philprene 1500, 1502.....lb. | .295 | b |
| 1503.....lb. | .2625 | b |
| Plioflex 1500, 1502.....lb. | .241 | * |
| Polyar Kryflex 200.....lb. | .255 | * |
| SS-250.....lb. | .2875 | * |
| Krylene, NS.....lb. | .241 | * |
| S-1500, -1501, -1502.....lb. | .23 | b |
| Synpol 1500, 1502, 1551.....lb. | .241 | b |

Cold SBR Black Masterbatch

| | | |
|----------------------------------|-------|---|
| Baytown 1600, 1601, 1602.....lb. | .176 | * |
| Philprene 1600, 1601.....lb. | .193 | b |
| 1605.....lb. | .19 | b |
| S-1600, -1601, -1602.....lb. | .1825 | * |

Cold SBR Oil Masterbatch

| | | |
|-----------------------------|-------|---|
| Ameripol 1703.....lb. | .206 | * |
| 1705.....lb. | .2035 | * |
| 1707, 1708.....lb. | .191 | * |
| 1710, 1712.....lb. | .1885 | * |
| ASRC 1703.....lb. | .206 | * |
| 1708.....lb. | .191 | * |
| Copo 1712.....lb. | .1885 | * |
| FR-S 1703.....lb. | .206 | * |
| 1705.....lb. | .2035 | * |
| 1712.....lb. | .1885 | * |
| Philprene 1703.....lb. | .206 | * |
| 1706.....lb. | .203 | b |
| 1708.....lb. | .191 | b |
| 1712.....lb. | .1885 | b |
| Plioflex 1703, 1773.....lb. | .206 | * |
| 1710, 1712.....lb. | .1885 | * |
| 1778.....lb. | .191 | * |
| Polyar Krynol 651.....lb. | .1885 | * |
| 652.....lb. | .191 | * |
| S-1703.....lb. | .195 | * |
| 1701, 1706.....lb. | .1925 | * |
| -1707.....lb. | .18 | * |
| -1709, -1712.....lb. | .1775 | * |
| Synpol 1703.....lb. | .206 | b |
| 1707, 1708.....lb. | .191 | b |
| 1711.....lb. | .19 | b |
| 1712.....lb. | .1945 | b |

Cold SBR Oil-Black Masterbatch

| | | |
|------------------------|-------|---|
| Baytown 1801.....lb. | .16 | * |
| Philprene 1803.....lb. | .174 | b |
| S-1801.....lb. | .1675 | * |
| -1803.....lb. | .165 | * |

Hot SBR Latexes

| | | |
|-----------------------------------|-------|---|
| FR-S 2000, 2001.....lb. | .3325 | * |
| 2002, 2003, 2004.....lb. | .35 | * |
| 2006.....lb. | .372 | * |
| Naugatex 2000, 2001, 2006.....lb. | .263 | * |
| 2002.....lb. | .288 | * |
| 2005, -1712.....lb. | .30 | * |
| Pliolite Latex 2000, 2001.....lb. | .2825 | * |
| 2076.....lb. | .295 | * |
| S-2000.....lb. | .2275 | * |
| 2006.....lb. | .215 | * |

Cold SBR Latexes

| | | |
|-----------------------------|------|---|
| Copo 2101, X-765.....lb. | .30 | * |
| 2102, 2105.....lb. | .32 | * |
| FR-S 2105.....lb. | .356 | * |
| Naugatex 2101.....lb. | .285 | * |
| 2105.....lb. | .312 | * |
| X-767.....lb. | .323 | * |
| Pliolite Latex 2101.....lb. | .30 | * |
| 2105.....lb. | .325 | * |
| 2107.....lb. | .325 | * |
| 2108.....lb. | .305 | * |
| S-2101.....lb. | .225 | * |
| -2105.....lb. | .31 | * |
| -2107.....lb. | .32 | * |

Cold BR Latex§

| | | |
|-----------------------------|------|---|
| Pliolite Latex 2104.....lb. | .325 | * |
|-----------------------------|------|---|

CLASSIFIED ADVERTISEMENTS

All Classified Advertising
Must Be Paid in Advance
(No agency commission allowed
except on display units)

Letter replies forwarded without charge, but no packages or samples.

ADDRESS ALL REPLIES TO NEW YORK OFFICE AT 386 FOURTH AVENUE, NEW YORK 16, N. Y.

GENERAL RATES Light face type \$1.25 per line (ten words)
Bold face type \$1.60 per line (eight words)

SITUATIONS WANTED RATES Light face type 40c per line (ten words)
Bold face type 55c per line (eight words)

SITUATIONS OPEN RATES Light face type \$1.00 per line (ten words)
Bold face type \$1.40 per line (eight words)
Allow nine words for keyed address.

SITUATIONS OPEN

TECHNICAL SALES REPRESENTATIVE

If you're a graduate chemist or chemical engineer—with proven industrial sales experience in the rubber industry and a working knowledge of compounding, processing and product application—and interested in an excellent base salary, plus additional worthwhile benefits, a major synthetic rubber manufacturer offers an unusual opportunity for growth and advancement in a new Technical Sales organization now being staffed.

To investigate the opportunity, in the strictest confidence, please forward a resumé detailing academic training, business experience, age and other pertinent data.

TEXAS—U. S. CHEMICAL COMPANY
260 Madison Avenue
New York 20, N. Y.

"INVESTIGATE SOUTH CAROLINA"

1. Rubber Adhesive Chemist or Chemical Engineer
 2. Urethane Foam Chemist or Engineer
 3. Research Director—Ph.D. or equivalent
 4. Rubber Mill—Plant Manager
 5. Rubber Mill—Plant Engineer—Mechanical
- Write or call today. CONTINENTAL TAPES, Cayce, S. C.

WANTED. AGENT TO REPRESENT PLASTIC INJECTION MOLDING company for custom molding. Must have excellent contacts with toy and novelty manufacturers, automotive, appliances, or other industries who are large users of plastic products. Give full information first letter. Address Box No. 2194, care of RUBBER WORLD.

CHIEF CHEMIST

Excellent opportunity—Salary open. Qualifications must include leadership, technical competency, and administrative ability. Age 35 to 50. Experience must include rubber, plastics, and industrial finishes. All replies held strictly confidential. Address Box No. 2195, care of RUBBER WORLD.

CHIEF MECHANICAL ENGINEER—DEVELOPMENT & RESEARCH

Excellent opportunity—salary open. Qualifications must include leadership, technical competency and administrative ability. Age 35 to 50. Man required must have broad background covering all phases of machine designing, tool making, and some production or plant engineering experience in fields of rubber, plastics, and metal. All replies held strictly confidential. Address Box No. 2196, care of RUBBER WORLD.

SITUATIONS OPEN (Con't.)

REPRESENTATIVE FOR NEW ENGLAND EASTERN SEABOARD territory, SEMIretired or any one qualified, thoroughly familiar with Rubber & Plastic Machinery and the used market. Full or part-time basis. Strictly on substantial commission basis. Prefer man with investment capital. Established firm is now in similar line. Address Box No. 2197, care of RUBBER WORLD.

MANUFACTURERS' REPRESENTATIVES WANTED BY SMALL midwestern rubber company making molded and lathe-cut rubber products. Prefer experienced men having good contacts. Address Box No. 2198, care of RUBBER WORLD.

RUBBER CHEMIST

Excellent opportunity for rubber chemist experienced in compounding and manufacturing chemically blown sponge rubber. Duties will involve taking complete charge of all phases of development and manufacturing of sponge products. Closed-cell experience desirable, but not essential. Address Box No. 2199, care of RUBBER WORLD.

WANTED—CHEMIST EXPERIENCED IN LATEX IMPREGNATION of paper. Salary open. Our personnel aware of this ad. Give details in first letter. All replies considered confidential. Address Box No. 2201, care of RUBBER WORLD.

SITUATIONS WANTED

PERMANENT OPPORTUNITY DESIRED—TECHNICAL, SALES, or??? Resident Southern California. 20 Years' excellent varied experience as chemist, mostly mechanical rubber, some sales, business, etc. Prefer large potential to immediate high income. Address Box No. 2186, care RUBBER WORLD.

TECHNICAL SALES-SERVICE

Graduate Chemical Engineer desires position. Rubber compounder for ten years. Some experience with plastics and paints. Several years' sales experience. Address Box No. 2189, care of RUBBER WORLD.

CHEMIST—B.S., M.A., 30, MARRIED. SUPERVISORY EXPERIENCE—rubber and resin based adhesives, polymers, coatings, thermosetting and thermoplastic resins. Well seasoned—Quality control, Research, Product development, Production, Administration. Desires challenging responsible position. Address Box No. 2190, care of RUBBER WORLD.

RUBBER COMPOUNDING. TECHNICAL ASSISTANCE OR manufacturing. 15 Years' experience. Natural rubber. Mechanical goods in Holland. 1 Year wire and cable, synthetics, U. S. 30-mile radius Los Angeles. Presently employed. Address Box No. 2191, care of RUBBER WORLD.

RUBBER TECHNOLOGIST DESIRES RESPONSIBLE POSITION. Seventeen years' experience in overall operations. Background includes compounding, research, development, production, cost estimation, management, etc. Address Box No. 2192, care of RUBBER WORLD.

TECHNICAL SALES AND/OR SERVICE TO THE RUBBER AND allied industries. Over sixteen years' experience in development, compounding, manufacturing, as well as technical service and sales. Address Box No. 2193, care of RUBBER WORLD.

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SILICONE RUBBER SE-460

3600 lbs. Two months old, perfect condition in original unopened General Electric Co. cartons. Considerably below market price. RAMBACH CHEMICAL COMPANY, 93-03 Sutphin Boulevard, Jamaica 35, New York. Telephone: AXtel 7-8900.

(Classified Advertisements Continued on Page 341)

HOWE MACHINERY CO., INC.

30 Gregory Avenue.

Passaic, N. J.

DESIGNERS & BUILDERS OF "V" BELT MANUFACTURING EQUIPMENT

Cord Latexing, expanding mandrels, automatic cutting
skiving, flipping and roll drive wrapping machines

ENGINEERING FACILITIES FOR SPECIAL EQUIPMENT

Call or Write

Compounding Ingredients*

| Abrasives | | |
|-------------------------------|-----------|---------|
| Pumicestone, powdered.....lb. | \$0.0363/ | \$0.065 |
| Rottenstone, domestic.....lb. | .03 | .04 |
| Shellblast.....ton | 80.00 | 165.00 |
| Walnut Shell Grits.....ton | 50.00 | 160.00 |

| Accelerators | | |
|---|------|------|
| A-1 (Thiocarbamide).....ton | .50 | .57 |
| A-32.....ton | .66 | .80 |
| A-100.....lb. | .52 | .66 |
| Accelerator 49.....lb. | .59 | .60 |
| 52.....lb. | 1.14 | |
| 57, 62, 67, 77.....lb. | 1.04 | |
| 66.....lb. | 4.25 | |
| 89.....lb. | 1.20 | |
| 108.....lb. | .92 | .97 |
| 552.....lb. | 2.25 | |
| 808.....lb. | .66 | .68 |
| 833.....lb. | 1.17 | 1.19 |
| Altax.....lb. | .54 | .56 |
| Arazate.....lb. | 2.25 | 2.30 |
| Beutene.....lb. | .66 | .71 |
| Bismate.....lb. | 3.00 | |
| B-J-F.....lb. | .27 | .32 |
| Butasan.....lb. | 1.04 | |
| Butazate.....lb. | 1.04 | 1.09 |
| Butyl Accelerator Eight.....lb. | 1.35 | |
| Namate.....lb. | .45 | .50 |
| Zimate.....lb. | 1.04 | |
| Ziram.....lb. | .89 | 1.04 |
| Cantax.....lb. | .44 | .46 |
| C-P-B.....lb. | 1.95 | 2.00 |
| Cumate.....lb. | 1.45 | |
| Diba.....lb. | .85 | |
| Diesterex N.....lb. | .50 | .57 |
| Dipac.....lb. | .85 | |
| DOTG (diorthotolylguanidine).....lb. | .64 | .65 |
| Cyanamid.....lb. | .62 | .63 |
| Du Pont.....lb. | .54 | .55 |
| DPG (diphenylguanidine).....lb. | .52 | .58 |
| Cyanamid.....lb. | .62 | .64 |
| El-Sixty.....lb. | 1.04 | |
| Ethasan.....lb. | 1.04 | 1.09 |
| Ethazate.....lb. | .87 | .92 |
| 50-D.....lb. | 3.00 | |
| Ethyl Seleram.....lb. | 1.04 | |
| Thiurad.....lb. | 1.04 | |
| Thiram.....lb. | 1.04 | 1.09 |
| Tuads.....lb. | 1.04 | |
| Tuex.....lb. | 1.04 | 1.09 |
| Zimate.....lb. | .89 | 1.04 |
| Ziram.....lb. | .93 | .95 |
| Guanthal.....lb. | .60 | .67 |
| Henteen.....lb. | .44 | .50 |
| Base.....lb. | 1.85 | 1.90 |
| Ledate.....lb. | 1.04 | |
| MBT (2-mercaptobenzothiazole).....lb. | .44 | .46 |
| American Cyanamid.....lb. | .42 | .44 |
| Du Pont.....lb. | .44 | .49 |
| Naugatuck.....lb. | .55 | .57 |
| -XXX, Cyanamid.....lb. | .55 | .57 |
| MBTS (mercaptobenzothiazyl disulfide).....lb. | .54 | .56 |
| Cyanamid.....lb. | .52 | .54 |
| Du Pont.....lb. | .54 | .59 |
| Naugatuck.....lb. | .59 | .61 |
| -W Cyanamid.....lb. | .75 | 1.05 |
| Merac #225.....lb. | .55 | .57 |
| Mertax.....lb. | 1.04 | |
| Methasan.....lb. | 1.04 | 1.09 |
| Methazate.....lb. | 1.14 | |
| Methyl Thiuram.....lb. | 1.14 | |
| Tuads.....lb. | 1.04 | |
| Zimate.....lb. | 1.14 | 1.19 |
| Monex.....lb. | 1.14 | |
| Mono-Thiurad.....lb. | 1.14 | |
| 2-MT (2-mercaptobenzothiazole).....lb. | .88 | .90 |
| Cyanamid.....lb. | 1.00 | .78 |
| Du Pont.....lb. | .80 | .82 |
| Special.....lb. | .55 | .60 |
| O-X-A-F.....lb. | .45 | .48 |
| Pennar SDB.....lb. | 1.24 | 1.29 |
| Pentex.....lb. | .30 | .35 |
| Flour.....lb. | 2.17 | .59 |
| Permalux.....lb. | .52 | .59 |
| Pip-Pip.....lb. | 2.07 | |
| R-2 Crystals.....lb. | 4.35 | |
| Rotax.....lb. | .55 | .57 |
| RZ-50, -50B.....lb. | 1.00 | |
| S. A. 52.....lb. | 1.14 | |
| 57, 62, 67, 77.....lb. | 1.04 | |
| 66.....lb. | 3.00 | |
| Santocure.....lb. | .76 | .78 |
| NS.....lb. | .80 | .82 |
| Selenacs.....lb. | 3.00 | |
| SPDX-GH.....lb. | .69 | .74 |
| GL.....lb. | 1.20 | 1.34 |
| Sulfad.....lb. | 1.98 | |
| Tellurac.....lb. | 1.30 | 1.55 |
| Tepidone.....lb. | .45 | .48 |
| Tetron A.....lb. | 1.91 | |
| Thiases.....lb. | .88 | 1.25 |
| Thionide.....lb. | .54 | .56 |
| S.....lb. | .64 | .66 |
| Thionex.....lb. | 1.14 | |
| Thiotax.....lb. | .44 | .46 |
| Thiurad.....lb. | 1.14 | |
| Thiuram E.....lb. | 1.04 | |
| M.....lb. | 1.14 | |

| | | |
|--------------------|--------|--------|
| Trimene.....lb. | \$0.56 | \$0.62 |
| Base.....lb. | 1.03 | 1.10 |
| Tuex.....lb. | 1.14 | |
| Ultex.....lb. | 1.00 | 1.10 |
| Unads.....lb. | 1.14 | |
| Ureka Base.....lb. | .66 | .73 |
| Vulcure NB.....lb. | .45 | |
| NS.....lb. | .75 | 1.05 |
| ZB, ZE, ZM.....lb. | .85 | .80 |
| Z-B-X.....lb. | 2.45 | 2.50 |
| Zenite.....lb. | .52 | .54 |
| A.....lb. | .62 | .64 |
| Special.....lb. | .53 | .55 |
| Zetax.....lb. | .51 | .53 |
| Zimate.....lb. | 1.04 | |

| Accelerator-Activators, Inorganic | | |
|-----------------------------------|-------|-------|
| Lime, hydrated.....ton | 21.96 | |
| Litharge, comml.....lb. | .1575 | .18 |
| Eagle, sublimed.....lb. | .1585 | .19 |
| National Lead, sublimed.....lb. | .1635 | .195 |
| Red lead, comml.....lb. | .185 | .195 |
| Eagle.....lb. | .1625 | |
| National Lead.....lb. | .19 | |
| White lead, carbonate.....lb. | .19 | .20 |
| Eagle.....lb. | .175 | .185 |
| National Lead.....lb. | .175 | .185 |
| Silicate.....lb. | .1725 | .185 |
| Eagle.....lb. | .16 | .17 |
| National Lead.....lb. | .16 | .17 |
| Zinc oxide, comml.....lb. | .145 | .1925 |

| Accelerator-Activators, Organic | | |
|----------------------------------|-------|-------|
| Aktone.....lb. | .2125 | .2325 |
| Barak.....lb. | .62 | |
| Capital 170.....lb. | .20 | .25 |
| 171.....lb. | .1425 | .1925 |
| 700, 701.....lb. | .16 | .21 |
| 705, 710.....lb. | .16 | .21 |
| 800.....lb. | .1325 | .1575 |
| 801.....lb. | .165 | .19 |
| 802.....lb. | .17 | .195 |
| 803.....lb. | .1925 | .2175 |
| Curade.....lb. | .57 | .59 |
| D-B-A.....lb. | 1.95 | |
| Emery 600.....lb. | .1425 | .1925 |
| Groco 30.....lb. | .1425 | .1925 |
| 35.....lb. | .1475 | .1975 |
| Guanthal.....lb. | .62 | .64 |
| Hyfac 400.....lb. | .1062 | .1375 |
| 430.....lb. | .18 | .205 |
| 431.....lb. | .2025 | .2275 |
| Hystrene S-97.....lb. | .1863 | .2125 |
| T 45.....lb. | .1638 | .19 |
| T-70.....lb. | .1738 | .20 |
| Industrene B.....lb. | .1263 | .1525 |
| R.....lb. | .1138 | .14 |
| 158.....lb. | .1313 | .1575 |
| 254.....lb. | .1413 | .1675 |
| 262.....lb. | .1513 | .1775 |
| Laurex.....lb. | .34 | .38 |
| MODX.....lb. | .295 | .345 |
| NA-22.....lb. | 1.00 | |
| Oleic acid, comml.....lb. | .185 | .225 |
| Emersol 210 Elaine.....lb. | .16 | .21 |
| Groco 2, 4, 8, 18.....lb. | .16 | .21 |
| Plastone.....lb. | .27 | .30 |
| Polyac.....lb. | 1.85 | |
| Ridact.....lb. | .25 | .26 |
| Seedine.....lb. | .1485 | .1703 |
| Stearax Beads.....lb. | .1488 | .1588 |
| Stearic acid.....lb. | .19 | |
| Emersol 120.....lb. | .2225 | |
| 150.....lb. | .09 | |
| Hydrofool 51.....lb. | .09 | |
| Hydrogenated, rubber grd.....lb. | | |
| Groco 56.....lb. | .1275 | .1525 |
| Rufat 75.....lb. | .1062 | .1325 |
| Single pressed, comml.....lb. | .1475 | .1675 |
| Emersol 110.....lb. | .165 | .19 |
| Groco 53.....lb. | .165 | .19 |
| Wilmar 253.....lb. | .1525 | .1775 |
| Double pressed, comml.....lb. | .1525 | .1725 |
| Groco 54.....lb. | .17 | .195 |
| Wilmar 254.....lb. | .1575 | .1825 |
| Triple pressed, comml.....lb. | .175 | .195 |
| Groco 55.....lb. | .1925 | .2175 |
| Wilmar 255.....lb. | .1875 | .2125 |
| Sterene 60-R.....lb. | .09 | .1075 |
| Tonox.....lb. | .515 | .605 |
| Vimbra.....lb. | .32 | .385 |
| Vulklor.....lb. | .88 | 1.08 |
| Wilmar 110.....lb. | .17 | .22 |
| 434.....lb. | .1425 | .1925 |
| Zinc stearate, comml.....lb. | .39 | .44 |

| Antioxidants | | |
|----------------------|------|------|
| AC-1.....lb. | .37 | .86 |
| -S.....lb. | 1.49 | 1.63 |
| AgeRite Alba.....lb. | 2.40 | 2.50 |
| Gel.....lb. | .70 | .72 |
| H. P.....lb. | .79 | .81 |
| Hipar.....lb. | 1.05 | 1.07 |
| Powder.....lb. | .57 | .59 |

| Antiozonants | | |
|-------------------------------------|--------|--------|
| Age Resin.....lb. | \$0.88 | \$0.90 |
| D.....lb. | .57 | .59 |
| Spaf.....lb. | .57 | .59 |
| Stalite.....lb. | .57 | .59 |
| S.....lb. | .57 | .59 |
| Superlite.....lb. | .57 | .59 |
| White.....lb. | 1.50 | 1.60 |
| Akroflex C.....lb. | .81 | .83 |
| CD.....lb. | .76 | .78 |
| Albasan.....lb. | .69 | .73 |
| Allied AA 1144.....lb. | .23 | .24 |
| AA-1177.....lb. | .155 | .165 |
| Aminox.....lb. | .57 | .60 |
| Antioxidant 425.....lb. | 2.47 | 2.50 |
| 2246.....lb. | 1.50 | 1.53 |
| Antisol.....lb. | .23 | .24 |
| Antisun.....lb. | .15 | .51 |
| Antox.....lb. | .55 | .57 |
| Aranox.....lb. | 3.25 | 3.30 |
| Betanox Special.....lb. | .91 | .96 |
| B-L-E, -25.....lb. | .57 | .62 |
| Burgess Antisun Wax.....lb. | .185 | |
| B-X-A.....lb. | .55 | .60 |
| Catalin AC-5.....lb. | 1.49 | 1.63 |
| Copper Inhibitor X-872-L.....lb. | 2.01 | |
| D-B-P-C.....lb. | .91 | 1.19 |
| Flectol H.....lb. | .57 | .58 |
| Flexamine.....lb. | .79 | .84 |
| Heliozone.....lb. | .31 | .32 |
| Ionol.....lb. | .91 | 1.65 |
| Microflake.....lb. | .20 | .24 |
| Naugawhite.....lb. | .57 | .62 |
| NBC.....lb. | 1.55 | |
| Neozone A.....lb. | .59 | .61 |
| C.....lb. | .83 | |
| D.....lb. | .55 | .57 |
| Neogastan A.....lb. | .51 | .61 |
| B.....lb. | .57 | .62 |
| Octamine.....lb. | .51 | .62 |
| PDA-10.....lb. | .46 | .48 |
| Perfectol.....lb. | .61 | .68 |
| Permalux.....lb. | 2.17 | |
| Polygard.....lb. | .57 | .62 |
| Polylite.....lb. | .55 | .60 |
| Protector.....lb. | .26 | .31 |
| Rio Resin.....lb. | .60 | .62 |
| Santoflex 35.....lb. | .72 | .73 |
| 35.....lb. | 1.01 | 1.03 |
| SAV.....lb. | .79 | .81 |
| B.....lb. | .52 | .59 |
| BX.....lb. | .63 | .70 |
| DD.....lb. | .57 | .59 |
| Santovar A.....lb. | 1.55 | 1.57 |
| Santowhite Crystals, Powder.....lb. | 1.55 | 1.62 |
| L.....lb. | .57 | .59 |
| MK.....lb. | 1.25 | 1.32 |
| Stabilite.....lb. | .55 | .59 |
| Alba.....lb. | .72 | .79 |
| L.....lb. | .60 | .64 |
| White.....lb. | .52 | .60 |
| Powder.....lb. | .41 | .47 |
| Styphen I.....lb. | .51 | .55 |
| Sunolite #100.....lb. | .21 | .23 |
| #127.....lb. | .17 | .19 |
| Sunproof-713.....lb. | .26 | .31 |
| Improved.....lb. | .25 | .30 |
| Jr.....lb. | .22 | .27 |
| Tenamene 3.....lb. | .91 | 1.05 |
| Thermoflex.....lb. | 1.00 | 1.02 |
| Tonox.....lb. | .54 | .59 |
| Tyomite.....lb. | .24 | .2475 |
| Velvapex 51-250.....lb. | .40 | |
| V-G-B.....lb. | .75 | .80 |
| Wing-Stay S.....lb. | .55 | .67 |
| Zalba.....lb. | 1.10 | |
| Zenite.....lb. | .52 | .54 |

| Antiozonants | | |
|--------------------------|------|------|
| Eastozone 30, 31.....lb. | 1.24 | 1.26 |
| 32.....lb. | 1.70 | 1.72 |
| Tenamene 30, 31.....lb. | 1.24 | 1.28 |
| UOP 88, 288.....lb. | 1.24 | 1.26 |

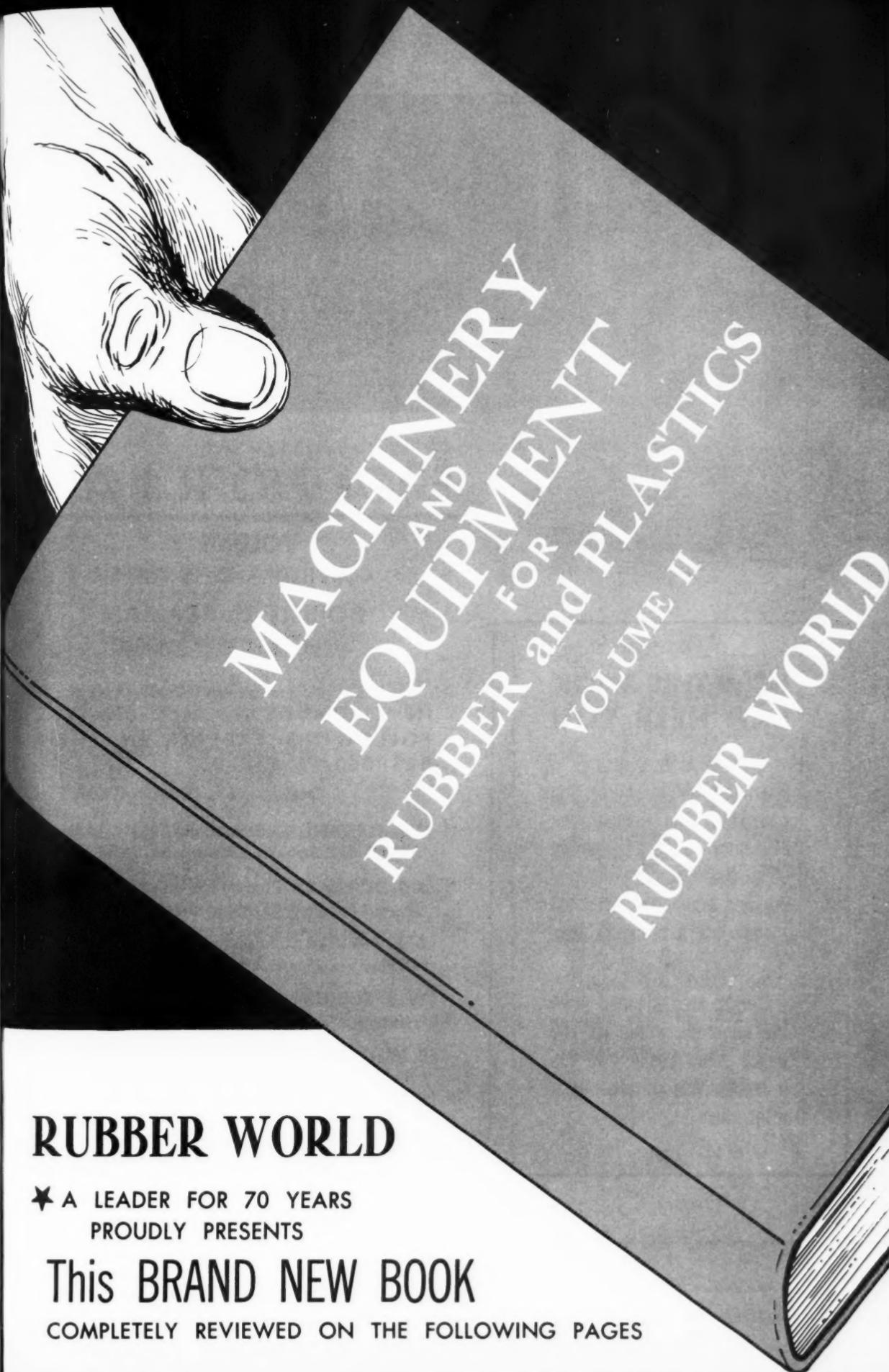
| Antiseptics | | |
|----------------------------------|------|------|
| Copper naphthenate, 6-8%.....lb. | .245 | |
| Pentachlorophenol.....lb. | .22 | .30 |
| Resorcinol, technical.....lb. | .775 | .785 |
| Zinc naphthenate, 8-10%.....lb. | .245 | .30 |

| Blowing Agents | | |
|---------------------------------|------|------|
| Ammonium bicarbonate.....lb. | .07 | .09 |
| Carbonate.....lb. | .16 | |
| Blowing Agent CP 1475.....lb. | .32 | .35 |
| Celogen.....lb. | 1.95 | 2.00 |
| 50 C.....lb. | 1.01 | 1.07 |
| Kempore R-125.....lb. | 1.95 | |
| Opex 40.....lb. | .76 | |
| Sodium bicarbonate.....100 lbs. | 2.55 | 3.85 |
| Carbonate, tech.....100 lbs. | 1.35 | 5.52 |
| Sponge Paste.....lb. | .20 | |
| Unicel ND.....lb. | .76 | |
| NDX.....lb. | 1.52 | |
| S.....lb. | .20 | |

| Bonding Agents | | |
|---|-------|-------|
| Braze.....gal. | 6.00 | 9.00 |
| Cover cement.....gal. | 2.50 | 4.00 |
| Chemlok 201, 203.....gal. | 5.00 | 7.50 |
| 220.....gal. | 9.25 | 12.00 |
| 401.....gal. | 11.70 | 14.40 |
| 602.....gal. | 25.00 | 26.00 |
| 607.....gal. | 18.00 | |
| 614.....gal. | 4.35 | 4.75 |
| Flocking Adhesive RFA17, RFA22, RFA25.....lb. | .50 | |

* Prices, in general, are f.o.b. works. Range indicates grade or quantity variations. No guarantee of these prices is made. Spot prices should be obtained from individual suppliers.

† For trade names, see Color—White, Zinc Oxides.
‡ At the request of the suppliers, the lowest prices shown for carbon blacks are for carloads in bags. Prices for hopper carloads are lower.



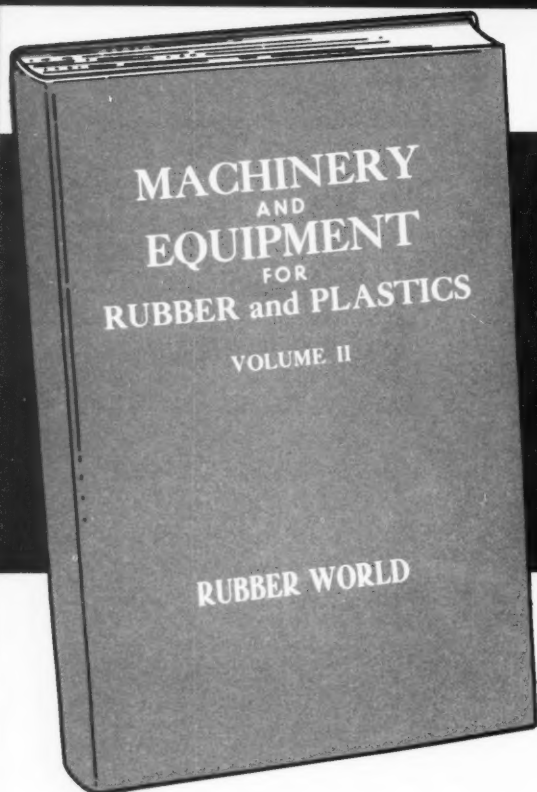
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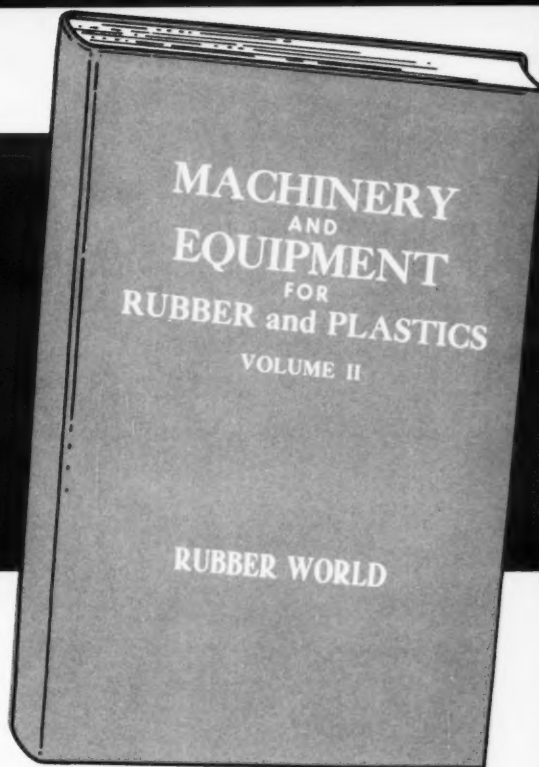
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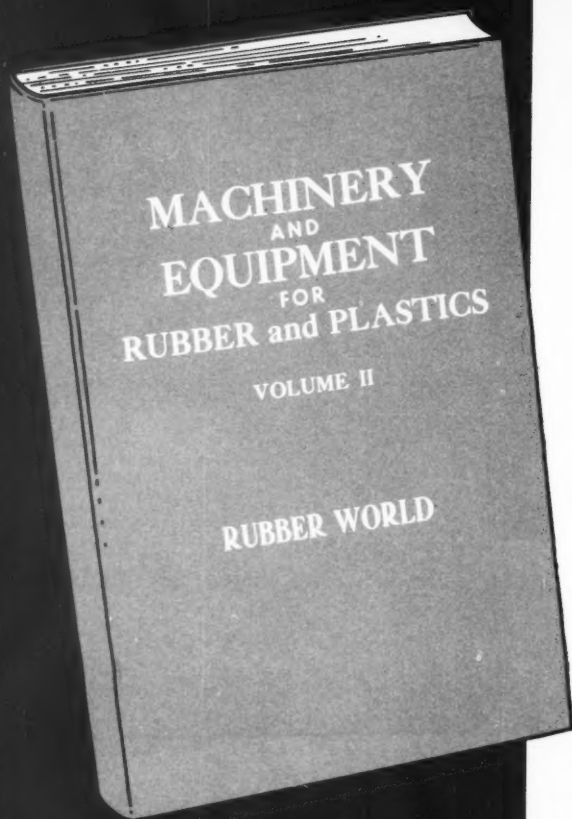
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Brake Lining Saturants

| | | | |
|---------------------|-------|---|-------|
| BRT 3.....lb. | .018 | / | .0265 |
| Resinex L-S.....lb. | .0225 | / | .03 |

Carbon Blacks†

Conductive Channel—CC

| | | | |
|--------------------------|-----|---|------|
| Continental R-40.....lb. | .23 | / | .30 |
| Kosmos/Dixie BB.....lb. | .23 | / | .30 |
| Spheron C.....lb. | .15 | / | .195 |
| Voltex.....lb. | .18 | / | .315 |

Easy Processing Channel—EPC

| | | | |
|----------------------------------|-------|---|-------|
| Collocarb EPC.....lb. | .059 | / | .0997 |
| Continental AA.....lb. | .074 | / | .1225 |
| Kosmobile 77/Dixiedensed.....lb. | .074 | / | .1225 |
| 77.....lb. | .074 | / | .1225 |
| Micronex W-6.....lb. | .0725 | / | .145 |
| Spheron #.....lb. | .0725 | / | .1225 |
| Texas E.....lb. | .0725 | / | .145 |
| Witco #12.....lb. | .074 | / | .1225 |
| Wyex EPC.....lb. | .075 | / | .135 |

Hard Processing Channel—HPC

| | | | |
|------------------------------------|-------|---|-------|
| Continental F.....lb. | .074 | / | .1225 |
| HX HPC.....lb. | .074 | / | .1225 |
| Kosmobile S-66/Dixiedensed.....lb. | .074 | / | .1225 |
| S.....lb. | .074 | / | .1225 |
| Micronex Mk. II.....lb. | .0775 | / | .145 |
| Witco #6.....lb. | .074 | / | .1225 |

Medium Processing Channel—MPC

| | | | |
|------------------------------------|-------|---|-------|
| Arrow MPC.....lb. | .0775 | / | .135 |
| Continental A.....lb. | .074 | / | .1225 |
| Kosmobile S-66/Dixiedensed.....lb. | .0775 | / | .145 |
| S-66.....lb. | .0775 | / | .145 |
| Micronex Standard.....lb. | .0725 | / | .145 |
| Spheron #6.....lb. | .0725 | / | .1225 |
| Texas 109.....lb. | .084 | / | .1475 |
| M.....lb. | .0775 | / | .145 |
| Witco #1.....lb. | .074 | / | .1225 |

Conductive Furnace—CF

| | | | |
|-------------------|-------|---|------|
| Aromex CF.....lb. | .0875 | / | .145 |
| Vulcan C.....lb. | .105 | / | .15 |
| SC.....lb. | .18 | / | .223 |

Fast Extruding Furnace—FEF

| | | | |
|----------------------------|-------|---|------|
| Arovel FEF.....lb. | .0675 | / | .125 |
| Continex FEF.....lb. | .06 | / | .10 |
| Kosmos 50/Dixie 50.....lb. | .06 | / | .10 |
| Philblack A.....lb. | .0675 | / | .115 |
| Statex M.....lb. | .0625 | / | .125 |
| Sterling SO.....lb. | .0625 | / | .10 |

Fine Furnace—FF

| | | | |
|---------------------|-------|---|------|
| Statex B.....lb. | .0675 | / | .13 |
| Sterling 99.....lb. | .0675 | / | .105 |

High Abrasion Furnace—HAF

| | | | |
|----------------------------|-------|---|-------|
| Aromex HAF.....lb. | .0775 | / | .135 |
| Continex HAF.....lb. | .079 | / | .125 |
| Kosmos 60/Dixie 60.....lb. | .079 | / | .1175 |
| Philblack O.....lb. | .0775 | / | .125 |
| Statex R.....lb. | .0725 | / | .135 |
| Vulcan #3.....lb. | .0725 | / | .114 |

Intermediate Super Abrasion Furnace—ISAF

| | | | |
|----------------------------|-------|---|------|
| Aromex ISAF.....lb. | .0925 | / | .15 |
| Kosmos 70/Dixie 70.....lb. | .10 | / | .145 |
| Philblack I.....lb. | .0925 | / | .14 |
| Statex 125.....lb. | .0825 | / | .15 |
| Vulcan 6.....lb. | .0875 | / | .13 |

Super Abrasion Furnace—SAF

| | | | |
|---------------------|------|---|-------|
| Philblack E.....lb. | .115 | / | .1625 |
| Statex 160.....lb. | .11 | / | .18 |
| Vulcan 9.....lb. | .115 | / | .165 |

General-Purpose Furnace—GPF

| | | | |
|------------------------|------|---|-------|
| Arogen GPF.....lb. | .06 | / | .1175 |
| Statex G.....lb. | .055 | / | .1175 |
| Sterling V.....lb. | .055 | / | .09 |
| V Non-staining.....lb. | .05 | / | .09 |

High Modulus Furnace—HMF

| | | | |
|----------------------------|-------|---|------|
| Collocarb HMF.....lb. | .045 | / | .085 |
| Continex HMF.....lb. | .055 | / | .095 |
| Kosmos 40/Dixie 40.....lb. | .055 | / | .095 |
| Modulex HMF.....lb. | .0625 | / | .12 |
| Statex 93.....lb. | .0575 | / | .12 |
| 980.....lb. | .047 | / | .087 |
| Sterling L, LL.....lb. | .0575 | / | .095 |

Semi-Reinforcing Furnace—SRF

| | | | |
|----------------------------|---------|---|---------|
| Collocarb SRF.....lb. | \$0.042 | / | \$0.082 |
| Continex SRF.....lb. | .045 | / | .085 |
| Essex SRF.....lb. | .0575 | / | .115 |
| Furnex.....lb. | .0525 | / | .115 |
| Gastex.....lb. | .0575 | / | .0925 |
| Kosmos 20/Dixie 20.....lb. | .045 | / | .085 |
| Pelletex, NS.....lb. | .0525 | / | .0875 |
| Sterling NS, S.....lb. | .0475 | / | .0875 |
| R.....lb. | .0575 | / | .0925 |

Fine Thermal—FT

| | | | |
|---------------------|-------|--|--|
| P-33.....lb. | .0575 | | |
| Sterling FT.....lb. | .0575 | | |

Medium Thermal—MT

| | | | |
|----------------------|-----|--|--|
| Sterling MT.....lb. | .04 | | |
| Non-staining.....lb. | .05 | | |
| Thermax.....lb. | .04 | | |
| Stainless.....lb. | .05 | | |

Colors

Black

| | | | |
|----------------------------|-------|---|------|
| Iron oxides, comml.....lb. | .1235 | / | .135 |
| BK—Lansco.....lb. | .1275 | / | .13 |
| Williams.....lb. | .145 | | |
| Lansco synthetic.....lb. | .10 | | |
| Mapico.....lb. | .1475 | / | .15 |
| Lampblack, comml.....lb. | .16 | / | .45 |
| Superjet.....lb. | .085 | / | .12 |
| Permanent Blue.....lb. | .80 | / | 1.05 |
| Stan-Tone.....lb. | .45 | / | 1.20 |
| Vansul masterbatch.....lb. | .60 | / | .65 |
| Paste.....lb. | .14 | / | .15 |

Blue

| | | | |
|-------------------------------|------|---|------|
| Alkali Blue G, R.....lb. | 2.38 | | |
| C. P. Iran Blues.....lb. | .52 | / | .54 |
| Du Pont.....lb. | 1.77 | / | 4.55 |
| Filo.....lb. | .28 | / | 1.45 |
| Heveatex pastes.....lb. | .80 | / | .80 |
| Lansco ultramarines.....lb. | .25 | / | .28 |
| Monsanto Blue 7.....lb. | 1.55 | | |
| 11.....lb. | 3.45 | | |
| DPB-283.....lb. | 1.93 | | |
| S-11.....lb. | 2.05 | | |
| Permanent Blue.....lb. | .80 | / | 1.05 |
| Stan-Tone Violet Blue.....lb. | 3.45 | | |
| D-4000.....lb. | 3.00 | | |
| 4001.....lb. | .90 | | |
| 4002.....lb. | 1.97 | / | 2.15 |
| 4900.....lb. | .90 | / | 2.70 |
| Vansul masterbatch.....lb. | .90 | / | 2.70 |

Brown

| | | | |
|------------------------------|-------|---|-------|
| Filo.....lb. | .13 | | |
| Iron oxides, comml.....lb. | .1425 | / | .145 |
| Lansco synthetic.....lb. | .125 | | |
| Mapico Brown.....lb. | .1575 | / | .16 |
| Sienna, burnt, comml.....lb. | .0425 | / | .155 |
| Williams.....lb. | .115 | / | .1775 |
| Raw, comml.....lb. | .045 | / | .1325 |
| Williams.....lb. | .08 | / | .1725 |
| Umber, burnt, comml.....lb. | .06 | / | .07 |
| Williams.....lb. | .0725 | / | .085 |
| Raw, comml.....lb. | .0625 | / | .07 |
| Williams.....lb. | .07 | / | .0825 |
| Williams, pure brown.....lb. | .155 | | |
| Vandyke.....lb. | .12 | | |
| Mapico Tan.....lb. | .2325 | / | .235 |
| Metallic Brown.....lb. | .05 | / | .06 |
| Vansul masterbatch.....lb. | 2.10 | / | 2.20 |

Green

| | | | |
|----------------------------|-------|---|------|
| Chrome.....lb. | .19 | / | .50 |
| Green.....lb. | .80 | / | 2.40 |
| Oxide.....lb. | .3925 | / | 1.10 |
| Cyanamid.....lb. | .42 | / | .44 |
| Green G.....lb. | 3.50 | / | 3.95 |
| Lincoln Green.....lb. | 5.30 | / | 6.60 |
| G-4099, -6099.....lb. | .4525 | | |
| GH-9869.....lb. | 1.10 | / | 1.25 |
| 9976.....lb. | 1.20 | / | 1.35 |
| Du Pont.....lb. | 1.97 | / | 2.80 |
| Filo.....lb. | .40 | | |
| Heveatex pastes.....lb. | .95 | / | 1.85 |
| Lansco Toner.....lb. | 1.35 | | |
| Monsanto Green 3.....lb. | 2.75 | | |
| 14.....lb. | 1.45 | | |
| 17.....lb. | 3.95 | | |
| 71205.....lb. | 1.35 | | |
| DGP.....lb. | 2.03 | | |
| S-17.....lb. | 2.25 | | |
| Stan-Tone.....lb. | 3.95 | | |
| D-5000.....lb. | .82 | | |
| 5001.....lb. | 1.45 | | |
| 5400.....lb. | 2.00 | / | 2.60 |
| Vansul masterbatch.....lb. | 2.00 | / | 2.60 |

Orange

| | | | |
|-------------------------------|------|---|------|
| Cyanamid Permatons.....lb. | 1.50 | / | 1.56 |
| Du Pont.....lb. | 2.75 | | |
| Monsanto Orange 68187.....lb. | 2.90 | | |
| Stan-Tone.....lb. | 4.06 | / | 4.26 |
| Light orange D-7003.....lb. | 2.50 | / | 2.92 |
| 70 PCO3.....lb. | 2.90 | / | 3.32 |
| Orange 70 PCO4.....lb. | 4.48 | / | 4.68 |
| D-7004.....lb. | 2.10 | / | 2.30 |
| D-7104.....lb. | 2.00 | / | 2.60 |
| Vansul masterbatch.....lb. | 2.00 | / | 2.60 |

| | | | |
|--------------------------------|---------|---|---------|
| Antimony trisulfide.....lb. | \$0.285 | / | \$0.315 |
| R. M. P. No. 3.....lb. | .72 | | |
| Sulfur Free.....lb. | .75 | | |
| Brilliant Toning Red.....lb. | 1.95 | | |
| Cadmium red lithopones.....lb. | 2.21 | / | 3.77 |
| Cadmolith.....lb. | 1.72 | / | 2.20 |
| Cyanamid.....lb. | .93 | / | 1.90 |
| Naphthol Red, Scarlet.....lb. | 2.95 | / | 3.80 |
| Du Pont.....lb. | 1.47 | / | 1.90 |
| Filo.....lb. | .11 | | |
| Indian Red.....lb. | .1275 | | |
| Iron oxide, comml.....lb. | .06 | / | .13 |
| Lansco synthetic.....lb. | .1175 | | |
| Mapico.....lb. | .1425 | / | 145 |
| Recco.....lb. | .12 | | |
| Williams Red.....lb. | .13 | / | 1525 |
| Monsanto Maroon 113.....lb. | 1.50 | | |
| 61148.....lb. | 1.75 | | |
| Red 7.....lb. | 1.55 | | |
| 41.....lb. | 4.40 | | |
| 3501.....lb. | 1.15 | | |
| 4004.....lb. | 1.50 | | |
| 69191.....lb. | 3.38 | | |
| Autumn.....lb. | 1.10 | | |
| PRP-285.....lb. | 1.27 | | |
| S-44.....lb. | 1.28 | | |
| Rub-Er-Red.....lb. | .0975 | | |
| Stan-Tone.....lb. | 1.25 | | |
| D-2000.....lb. | .98 | | |
| 2110, 2120, 2121.....lb. | 1.47 | | |
| 2200.....lb. | 1.90 | | |
| 2500.....lb. | 4.60 | | |
| 2601.....lb. | 1.60 | | |
| 2700.....lb. | 1.75 | | |
| 2800.....lb. | 1.90 | | |
| Light Red D-7005.....lb. | 5.23 | / | 5.43 |
| D-7105.....lb. | 2.26 | / | 2.46 |
| 70 PCO5.....lb. | 3.23 | / | 3.65 |
| Red D-7006.....lb. | 5.52 | / | 5.72 |
| D-7106.....lb. | 2.59 | / | 2.79 |
| 70 PCO6.....lb. | 3.63 | / | 4.05 |
| Vansul masterbatch.....lb. | .95 | / | 3.30 |
| Venetian.....lb. | .04 | / | .0675 |

White

| | | | |
|------------------------------|-------|---|-------|
| Antimony oxide.....lb. | .27 | / | .285 |
| Burgess Iceberg.....lb. | 50.00 | / | 80.00 |
| Cryptone BT.....lb. | .10 | / | .11 |
| Permolith lithopone.....lb. | .08 | / | .087 |
| Titanium pigments.....lb. | .25 | / | .27 |
| Horse Head Anatase.....lb. | .275 | / | .29 |
| Rutile.....lb. | .195 | / | .205 |
| Rayox LW.....lb. | .215 | / | .225 |
| R-110.....lb. | .075 | / | .0825 |
| Ti-Cal.....lb. | .195 | / | .225 |
| Ti-Pure.....lb. | .21 | / | .22 |
| Titanox A, AA, A-168.....lb. | .1225 | / | .1275 |
| C-50.....lb. | .23 | / | .24 |
| RA, -10, -50.....lb. | .0825 | / | .0875 |
| RC.....lb. | .08 | / | .085 |
| -HT, -HTX.....lb. | .255 | / | .29 |
| Unitane.....lb. | .245 | / | .27 |
| Zopaque Anatase.....lb. | .205 | / | .29 |
| Rutile.....lb. | .145 | / | .1825 |
| Zinc oxide, comml.....lb. | .145 | / | .1825 |
| Azo ZZZ-11, -44, -55.....lb. | .1505 | / | 1705 |
| 20% leaded.....lb. | .155 | / | .175 |
| 35% leaded.....lb. | .1588 | / | .1788 |
| 50% leaded.....lb. | .145 | / | .155 |
| Eagle AAA, lead free.....lb. | .145 | / | .155 |
| 5% leaded.....lb. | .155 | / | .165 |
| 35% leaded.....lb. | .159 | / | .169 |
| 50% leaded.....lb. | .1625 | / | .1725 |
| Florence Green Seal.....lb. | .1575 | / | .1675 |
| Red Seal.....lb. | .1675 | / | .1775 |
| White Seal.....lb. | .145 | / | .155 |
| Horsehead XX-4, -78.....lb. | .145 | / | .155 |
| Kadox-15, -17, -515.....lb. | .1675 | / | .1775 |
| -25.....lb. | .155 | / | .175 |
| Lehigh, 35% leaded.....lb. | .1588 | / | .1788 |
| 50% leaded.....lb. | .145 | / | .165 |
| Protex-166, -167.....lb. | .145 | / | .165 |
| St. Joe, lead free.....lb. | .253 | / | .263 |
| Zinc sulfide, comml.....lb. | .253 | / | .273 |
| Cryptone ZS.....lb. | .253 | / | .273 |

Yellow

| | | | |
|-----------------------------------|-------|---|-------|
| Cadmium yellow lithopones.....lb. | 1.12 | / | 1.15 |
| Cadmolith.....lb. | 1.12 | / | 1.20 |
| Cyanamid Hansa Yellow.....lb. | 2.20 | | |
| Du Pont.....lb. | 1.80 | / | 2.25 |
| Filo.....lb. | .10 | | |
| Iron oxide, comml.....lb. | .0525 | / | .1175 |
| Lansco synthetic.....lb. | .1075 | | |
| Mapico.....lb. | .12 | / | .1275 |
| Williams.....lb. | .115 | / | .1225 |
| Monsanto Yellow 14.....lb. | 1.91 | | |
| 10010.....lb. | 1.91 | | |
| BYP-282.....lb. | 1.21 | | |
| GA.....lb. | 2.45 | | |
| S-10010.....lb. | 1.17 | | |
| Stan-Tone.....lb. | 2.55 | | |
| D-1100.....lb. | .69 | | |
| 1101.....lb. | 1.77 | / | 2.19 |
| Lemon 70 PCO1.....lb. | 2.80 | / | 3.00 |
| D-7001.....lb. | 2.98 | / | 3.18 |
| Medium yellow 70 PCO2.....lb. | .95 | / | 1.95 |
| D-7002.....lb. | .0575 | / | .06 |
| Ansul masterbatch.....lb. | .95 | / | 1.95 |
| Williams Ocher.....lb. | .0575 | / | .06 |

| | | |
|---------------------------|--------|--------|
| Latex-Lube GR.....lb. | \$0.20 | |
| Pigmented.....lb. | 1.825 | |
| R-66.....lb. | 1.65 | |
| Liquid-Lube.....lb. | 1.625 | |
| N. T.....lb. | 1.675 | |
| Liquiline No. 305.....lb. | .30 | \$0.35 |
| Lubrex.....lb. | .25 | .30 |
| Mica, 160 Biotite.....lb. | .065 | .0725 |
| Mesh.....lb. | .08 | .0875 |
| 325 Mesh.....lb. | .0825 | .09 |
| Concord.....lb. | .08 | .09 |
| Mineralite.....ton | 45.00 | 15.00 |
| Pyrax A.....ton | 14.50 | 17.50 |
| W. A.....ton | 17.00 | 17.50 |
| Talc, comml.....ton | 18.40 | 38.50 |
| EM.....ton | 11.00 | 63.00 |
| LS Silver.....ton | 29.25 | |
| Nytals.....ton | 25.00 | 36.00 |
| Sierra Sagger 7.....ton | 34.00 | |
| White IR.....ton | 19.75 | |
| III.....ton | 20.75 | |
| Vanfre.....gal. | 2.00 | |

Extenders

| | | |
|----------------------------------|-------|-------|
| BRS 700.....lb. | .02 | .0285 |
| BRT 7.....lb. | .03 | .031 |
| Cumar Resins.....lb. | .065 | .17 |
| Dielez B.....lb. | .06 | |
| Factice, Amberex.....lb. | .29 | .36 |
| Brown.....lb. | .1425 | .263 |
| Neophax.....lb. | .157 | .268 |
| White.....lb. | .144 | .285 |
| G. B. Asphaltenes.....lb. | .097 | .177 |
| Miller, W.....lb. | .07 | |
| Mineral Rubbers.....ton | 38.00 | 40.00 |
| Black Diamond.....ton | 46.50 | 48.50 |
| Hard Hydrocarbon.....ton | 45.00 | 55.00 |
| Hydrocarbon MR.....ton | 21.00 | 29.00 |
| Parmir.....ton | 47.50 | 50.00 |
| T-MR Granulated.....ton | .0575 | .0625 |
| Nuba No. 1, 2.....lb. | .0775 | .0825 |
| 3X.....lb. | .26 | |
| OPD-101.....lb. | .16 | .2572 |
| Rubber substitute, brown.....lb. | .14 | |
| Car-Bel-Ex A.....lb. | .35 | |
| Car-Bel-Lite.....lb. | .1765 | |
| Extender 600.....lb. | .192 | .2103 |
| White.....lb. | 35.00 | 73.00 |
| Stan-Shells.....lb. | .215 | .235 |
| Sublac Resin PX-5.....gal. | 14.00 | 1725 |
| Sundex 53.....gal. | .41 | |
| 85.....lb. | .35 | .475 |
| Synthetic 100.....lb. | | |
| Vistanex.....lb. | | |

Fillers, Inert

| | | |
|-----------------------------------|--------|--------|
| Agrashell flour.....ton | 50.00 | 74.00 |
| Albacar.....ton | 55.00 | 75.00 |
| Barytes, floated, white.....ton | 49.00 | 70.85 |
| Off-color, domestic.....ton | 25.00 | |
| No. 1.....ton | 55.00 | 77.50 |
| 2.....ton | 50.00 | 72.50 |
| Sparmite.....ton | 95.00 | 117.00 |
| Blanc fixe.....ton | 100.00 | 165.00 |
| Burgess Iceberg.....ton | 50.00 | 80.00 |
| Pigment #20.....ton | 35.00 | 60.00 |
| #30.....ton | 37.00 | 60.00 |
| HC-75.....ton | 12.00 | 30.00 |
| -80.....ton | 14.00 | 32.00 |
| WP #1.....ton | 11.00 | 16.00 |
| Camel-Carb.....ton | 14.00 | |
| -Tex.....ton | 22.00 | |
| -White.....ton | 35.00 | |
| Cary #200.....ton | 30.00 | 55.00 |
| Citrus seed meal.....lb. | .04 | |
| Oil.....lb. | .15 | |
| Clays.....ton | 29.50 | 36.00 |
| A. F. D. Filler.....ton | 14.00 | |
| Alken.....ton | 50.00 | 55.00 |
| Albacar.....ton | 25.50 | 28.50 |
| Aluminum Flake, coarse.....ton | 29.50 | 36.00 |
| Fine.....ton | 27.50 | 34.50 |
| Champion.....ton | 14.50 | 33.00 |
| Crown.....ton | 14.00 | |
| Dixie.....ton | 14.50 | |
| Franklin.....ton | 13.50 | 35.25 |
| GK Soft Clay.....ton | 11.00 | |
| Harwick.....ton | 15.50 | 55.50 |
| Hi-White R.....ton | 14.50 | 19.50 |
| Hydratex R.....ton | 28.00 | |
| Kaoloid.....ton | 10.50 | |
| McNamee.....ton | 14.50 | |
| RX-43.....ton | 33.00 | |
| Natka 1200.....ton | 13.00 | |
| Par.....ton | 14.50 | 19.50 |
| Paragon.....ton | 14.00 | |
| Recco.....ton | 12.50 | |
| Sno-Brite.....ton | 28.00 | |
| Stan-Clay.....ton | 50.00 | |
| Stellar-R.....ton | 14.50 | 19.50 |
| Suprex.....ton | 12.50 | |
| Swanee.....ton | 14.00 | 30.00 |
| Windor.....ton | 1.45 | 1.65 |
| DC Silica.....ton | 32.00 | 48.00 |
| Diatomaceous silica.....ton | | |
| Flocks.....lb. | .095 | .135 |
| Cotton, dark.....lb. | .55 | .60 |
| Dyed.....lb. | .13 | .33 |
| White.....lb. | .135 | |
| Fabrilis X-24-G.....lb. | .235 | |
| X-24-W.....lb. | .33 | |
| Filfloc 6000.....lb. | .135 | |
| F-40-900.....lb. | 1.22 | 2.46 |
| HSC #35 Silicone Emulsion.....lb. | 52.50 | 67.50 |
| Kalite.....ton | | |

| | | |
|--|---------|---------|
| Lithopone, comml.....lb. | \$0.075 | \$0.085 |
| Astrolith.....lb. | .068 | .0675 |
| Eagle.....lb. | .0725 | .075 |
| Permolith.....lb. | .08 | .0875 |
| Sunolith.....lb. | .075 | .0825 |
| Mica, 160 Biotite.....lb. | .065 | .0725 |
| Mesh.....lb. | .08 | .0875 |
| 325 Mesh.....lb. | .0825 | .09 |
| Concord.....lb. | .08 | .09 |
| Millical.....ton | 38.00 | 53.00 |
| Mineralite.....ton | 40.00 | 60.00 |
| Non-Fer-Al.....ton | 35.00 | 50.00 |
| Ohio Superspray lime.....ton | 16.50 | |
| Pulverized limestone, Stone-lite.....ton | 8.25 | 11.00 |
| Purecal.....ton | 56.75 | 71.75 |
| Pyrax A.....ton | 13.50 | |
| W. A.....ton | 16.00 | |
| Sawdust.....ton | 14.00 | 35.00 |
| Silversheen Mica.....lb. | .08 | .09 |
| Stan-White.....ton | 10.50 | 13.10 |
| Super-White Silica.....ton | 25.00 | 46.50 |
| Surfax.....ton | 37.50 | 52.50 |
| MM.....ton | 42.00 | 57.00 |
| Supenso.....lb. | 38.00 | 53.00 |
| Ti-Cal.....lb. | .0675 | |
| Valron Esterail.....lb. | 2.00 | 2.25 |
| Walnut shell flour.....ton | 50.00 | 84.00 |
| Whiting, limestone.....ton | 32.50 | 35.00 |
| Atomite.....ton | 23.00 | |
| Calcite.....ton | 20.00 | 27.00 |
| Calwhite.....ton | 23.00 | |
| -T.....ton | 20.00 | |
| Duramite.....ton | 32.50 | 40.00 |
| Gamaco.....ton | 30.00 | 22.00 |
| Keystone.....ton | 11.00 | 16.50 |
| Laminar.....ton | 30.00 | |
| No. 10 White.....ton | 45.00 | |
| Omva.....ton | 14.50 | 22.50 |
| BSH.....ton | 17.00 | 18.00 |
| Paxinosa.....ton | 13.00 | |
| Snowflake.....ton | 9.50 | |
| Witco.....ton | | |
| York.....ton | | |

Finishes

| | | |
|---|------|-------|
| Apex Bright Finish #5200-E.....lb. | .28 | |
| Rubber Finish.....gal. | 2.50 | |
| Black-out.....gal. | 4.50 | 8.00 |
| Flocks, Rayon, colored.....lb. | .90 | 1.50 |
| White.....lb. | .75 | 1.25 |
| Also see Flocks, under Fillers, Inert | | |
| Parafint RG and RGU Syn-thetic Wax.....lb. | .15 | .22 |
| Rubber lacquer, clear.....gal. | 1.00 | 2.00 |
| Shellacs, Angelo.....lb. | .485 | .7325 |
| Vac Dry.....lb. | .485 | .57 |
| Talc (See Talc, under Dusting Agents).....lb. | .15 | .20 |
| Unidip.....lb. | .68 | .83 |
| Wax, Bees.....lb. | .57 | 1.13 |
| Carnauba.....lb. | .27 | |
| Monten.....gal. | .86 | 1.41 |
| No. 118, colors.....gal. | .76 | 1.31 |
| Neutral.....gal. | 1.45 | 1.50 |
| Van Wax.....gal. | | |

Latex Compounding Ingredients

| | | |
|----------------------------------|-------|-------|
| Acintol D, DLR.....lb. | .06 | .075 |
| FA #1.....lb. | .065 | .08 |
| #2.....lb. | .075 | .09 |
| Accelerator 552.....lb. | 2.25 | 1.15 |
| J-117, -302.....lb. | 1.00 | 1.15 |
| -14.....lb. | 1.10 | 1.25 |
| -307.....lb. | .60 | .75 |
| -311.....lb. | .39 | 1.20 |
| Aerosol, dry types.....lb. | .40 | .72 |
| Liquid types.....lb. | .20 | .24 |
| Alcogum AA-16, MA-16.....lb. | .12 | .14 |
| AK-12, PA-10.....lb. | .05 | .075 |
| AN-6.....lb. | .085 | .10 |
| Alrocol.....lb. | .41 | .18 |
| Amberex solutions.....lb. | 3.25 | 3.45 |
| Antifoam J-114.....lb. | .24 | .35 |
| P-242.....lb. | .55 | .70 |
| Antioxidant J-137, -140.....lb. | 1.45 | 1.60 |
| -139, -293.....lb. | 2.00 | 2.15 |
| -182.....lb. | 1.40 | 1.55 |
| -186.....lb. | 1.50 | 1.53 |
| 2246.....lb. | .75 | .90 |
| Anti Webbing Agent J-183.....lb. | .27 | .40 |
| -297.....lb. | .0975 | .1025 |
| Aquablak B.....lb. | .12 | .125 |
| G.....lb. | .12 | .125 |
| K.....lb. | .105 | .11 |
| M.....lb. | .78 | |
| Aquarex D.....lb. | .21 | |
| L.....lb. | .94 | |
| MDL.....lb. | .33 | |
| ME.....lb. | .80 | |
| Aquarex NS.....lb. | .60 | |
| SMO.....lb. | .50 | |
| WAQ.....lb. | .22 | |
| Areskap 50.....lb. | .30 | .38 |
| 100, dry.....lb. | .60 | .72 |
| Aresket 240.....lb. | .30 | .38 |
| 300, dry.....lb. | .60 | .72 |
| Aresklene 375.....lb. | .42 | .57 |
| Ben-A-Gels.....lb. | .98 | 1.40 |
| Bentone 18, 18C.....lb. | .45 | |
| 34.....lb. | .60 | |
| Casein.....lb. | .22 | |
| Cellulose WP-09, -3, -40.....lb. | 1.00 | 1.17 |
| -300.....lb. | .85 | |
| CW-12.....lb. | .70 | |
| -37.....lb. | | |

| | | |
|---|--------|--------|
| DC Antifoam A Compound.....lb. | \$5.45 | \$6.65 |
| B.....lb. | .68 | 1.20 |
| Emulsion.....lb. | 2.05 | 4.00 |
| AF Emulsion.....lb. | 2.05 | 2.85 |
| Compound 7.....lb. | 5.13 | 6.50 |
| Deforma W-1701.....lb. | .125 | |
| Defoamer 115a.....lb. | .50 | |
| Dispersing Agents.....lb. | | |
| Blancol.....lb. | .1525 | .26 |
| N.....lb. | .155 | .26 |
| Darvan Nos. 1, 2, 3.....lb. | .22 | .30 |
| Daxad 11, 21, 23, 27.....lb. | .08 | .30 |
| Dispersaid H7A.....lb. | .58 | |
| 1159.....lb. | .43 | |
| Emulphor ON-870.....lb. | .50 | .70 |
| Igepal CO-630.....lb. | .2875 | .47 |
| Igepon T-73.....lb. | .285 | .495 |
| T-77.....lb. | .45 | .69 |
| Indulins.....lb. | .06 | .08 |
| Kreelons.....lb. | .132 | .155 |
| Laurelton Oil.....lb. | .18 | |
| Leonil SA.....lb. | .52 | .65 |
| Lomar FW.....lb. | .18 | |
| Marasperse CB.....lb. | .1225 | .1425 |
| N.....lb. | .095 | .105 |
| Modicols.....lb. | .17 | .58 |
| Nekal BA-75.....lb. | .395 | .54 |
| BX-76.....lb. | .63 | .75 |
| Orzan A.....lb. | .0325 | |
| S.....lb. | .0425 | |
| Pluronica.....lb. | .335 | .40 |
| Polyfons.....lb. | .08 | .09 |
| Sorapan SF-78.....lb. | .28 | .40 |
| Tergitol NPX.....lb. | .275 | .3074 |
| TMN.....lb. | .2875 | .32 |
| Trenamine W-30.....lb. | .4125 | .44 |
| W-40.....lb. | .60 | .75 |
| Triton R-100.....lb. | .12 | .25 |
| X-100, -102, -114.....lb. | .255 | .36 |
| Dispersions.....lb. | | |
| Agebest 1293-22.....lb. | 1.90 | 2.00 |
| AgeRite Alba.....lb. | 3.00 | |
| Powder, Resin D.....lb. | .80 | |
| White.....lb. | 1.80 | |
| Altax.....lb. | .75 | |
| Shield Nos. 2, 6.....lb. | .08 | |
| 3.....lb. | .095 | |
| 4-35.....lb. | .09 | |
| 5.....lb. | .093 | |
| 7, 8.....lb. | .165 | |
| 55.....lb. | .18 | |
| Iron Oxide, 60%.....lb. | .40 | |
| L.S.W.....lb. | 1.50 | |
| No. 305 Liquizinc.....lb. | .30 | .35 |
| P-33.....lb. | .35 | |
| Retax.....lb. | .75 | |
| Sulfur.....lb. | .12 | .30 |
| No. 2.....lb. | .14 | .16 |
| Telloy.....lb. | 3.00 | |
| Tuads, Methyl.....lb. | 1.14 | |
| Vulcacure NB.....lb. | .45 | |
| 75.....lb. | | 1.05 |
| ZB, ZB, ZM.....lb. | .85 | .89 |
| Vulcanizing, C group.....lb. | .40 | 1.30 |
| G group.....lb. | .45 | .90 |
| N group.....lb. | .40 | 1.00 |
| Vulcafoams.....lb. | .40 | .70 |
| Vulcanols.....lb. | .75 | .80 |
| Zetax.....lb. | .75 | |
| Zimates, Butyl.....lb. | 1.04 | |
| Ethyl, Methyl.....lb. | 1.04 | |
| Zinc oxide.....lb. | .40 | |
| Emulsions.....lb. | | |
| AgeRite Statite.....lb. | .75 | |
| Borden Arcco A-25.....lb. | .18 | .19 |
| A-26, 716-30.....lb. | .185 | .205 |
| 555-40-R.....lb. | .29 | .21 |
| 620-32B.....lb. | .17 | .18 |
| 716-35.....lb. | .165 | .175 |
| 1041-21.....lb. | .195 | .20 |
| Habuco Resin Nos. 502, 515, 523.....lb. | .22 | .225 |
| 503.....lb. | .19 | .195 |
| 504, 526.....lb. | .175 | .18 |
| 517.....lb. | .155 | .16 |
| 524.....lb. | .175 | .25 |
| Resin A-2.....lb. | .12 | .22 |
| P-370.....lb. | .40 | |
| X-210.....lb. | .52 | |
| Freeze-Stabilizer 322.....lb. | .145 | .35 |
| 12116C.....lb. | .125 | .285 |
| Igepon T-43.....lb. | .285 | .495 |
| T-51.....lb. | .1675 | .195 |
| -73.....lb. | .41 | .48 |
| Ludox.....lb. | .75 | 1.05 |
| Marmix.....lb. | .06 | .072 |
| Merac.....lb. | 1.60 | |
| Micronex, colloidal.....lb. | 1.80 | |
| Monsanto Blue 4685 WD.....lb. | 1.25 | |
| Green 4884 WD.....lb. | .16 | .26 |
| Red 127.....lb. | .069 | .096 |
| OPD 101.....lb. | .32 | .41 |
| Picco Latex Plasticizer A-12.....lb. | .37 | .46 |
| Phillite Latex 150, 190.....lb. | .25 | .45 |
| 170.....lb. | .13 | |
| Polyvinyl methyl ether.....lb. | .46 | |
| Resin V.....lb. | .44 | .65 |
| Roeigel 100C.....lb. | .13 | .25 |
| Santomerac D.....lb. | .1275 | |
| S.....lb. | .905 | .975 |
| Sellogan Gel.....lb. | .245 | .265 |
| Sequestrene AA.....lb. | .585 | .615 |
| ST.....lb. | .75 | 1.05 |
| Setait #5.....lb. | .85 | 1.15 |
| D #9.....lb. | .80 | 1.10 |
| Stablex A.....lb. | .50 | .95 |
| B, G.....lb. | .27 | .35 |
| K.....lb. | | |

MACHINERY & SUPPLIES FOR SALE (Cont'd)

HYDRAULIC PRESSES, 2500-TON DOWNSTROKE 54" x 102", 325-Ton upstroke 28" x 28", 300-Ton upstroke 40" x 30", 300-Ton upstroke 22" x 35", 300-Ton multi-opening 40" x 40" platens, 250-Ton French Oil upstroke 38" x 28", 170-Ton upstroke 24" x 24", 150-Ton Elmes upstroke 36" x 25", 140-Ton 36" x 36" platens, 300-Ton Stokes Transfer Molding Press, New & Used Lab. 6" x 13", 6" x 16", and 8" x 16" Mills and Calenders, & sizes up to 84". Baker-Perkins & Day Heavy-Duty Jack. Mixers up to 200 gals. Hydraulic Pumps & Accumulators, Rotary Cutters. Colton 5 1/4 T 4T & 3DT Preform Machines motor driven. Other sizes in Single-Punch & Rotary Pre-Form Machines. Banbury Mixers, Crushers, Churns, Tubers, Vulcanizers, Bale Cutters, Gas Boilers, etc. SEND FOR SPECIAL BULLETIN. WE BUY YOUR SURPLUS MACHINERY. STEIN EQUIPMENT COMPANY, 107-8TH STREET, BROOKLYN 15, NEW YORK. STERLING 8-1944.

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FOR SALE: 3—6 x 12 Lab 2-roll mills, 3—100- & 150-gal. Baker Perkins heavy-duty Mixers 100 hp., 1—8" Extruder, 1—#1 Ball & Jewell Rotary Cutter, Powder Mixers, Tablet Presses, Screens. Your inquiries solicited. BRILL EQUIPMENT COMPANY, 2401 Third Ave., New York 51, N. Y.

(Classified Advertisements Continued on Page 343)

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(A.S.T.M. D676)
VARIOUS OTHER
MODELS FOR TESTING
THE ENTIRE RANGE
TECHNICAL DATA
ON REQUEST

THE SHORE INSTRUMENT & MFG. CO. INC.

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EXPRESSWAY
JAMAICA 35, N.Y.

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- Four styles, for standard pipe sizes 1/4" to 3".
- Write for information and prices.

| | | |
|----------------------|--------|--------|
| Stablex P.....lb. | \$0.35 | \$0.50 |
| T.....lb. | .14 | .22 |
| Surfactol 13.....lb. | .345 | .36 |
| Webnix.....lb. | 1.50 | 2.50 |

Mold Lubricants

| | | |
|--|-------|-------|
| Acintol D.....lb. | .06 | .75 |
| A-C Polyethylene.....lb. | .30 | .37 |
| Alipal CO-433.....lb. | .25 | .45 |
| CO-436.....lb. | .22 | .41 |
| Aquarex Compounds.....lb. | .21 | .94 |
| Carbowax 200, 300, 400.....lb. | .22 | .25 |
| 1500.....lb. | .255 | .2825 |
| 1000.....lb. | .31 | .36 |
| 6000.....lb. | .35 | .36 |
| Castorwax.....lb. | .3375 | .3575 |
| Colite Concentrate.....gal. | .90 | 1.15 |
| D-Tak Dip #10.....gal. | 1.50 | .33 |
| DC Mold Release Fluid.....lb. | 3.14 | 4.75 |
| Compound 4, 7.....lb. | 5.13 | 6.50 |
| Emulsion 7.....lb. | 1.59 | 2.07 |
| 8, 35, 35A, 35B, 36.....lb. | 1.22 | 1.76 |
| 200 Fluid.....lb. | 3.14 | 4.75 |
| EA.....lb. | .82 | .265 |
| FT Wax 200.....lb. | .265 | .42 |
| 300.....lb. | .295 | .45 |
| Glycerized Liquid Lubricant.....gal. | 1.25 | 1.63 |
| concentrated.....lb. | .2875 | .74 |
| Igepal.....lb. | .44 | .68 |
| Igepon AP-78.....lb. | .145 | .35 |
| T-43.....lb. | .125 | .285 |
| -51.....lb. | .285 | .495 |
| -73.....lb. | .27 | .32 |
| Lubrex.....gal. | 10.00 | 12.05 |
| Lubri-Flo.....lb. | .41 | .41 |
| Luatermold.....lb. | 3.50 | .37 |
| L-41 Diethyl Silicone Oil.....lb. | .25 | .25 |
| Mold Paste.....lb. | .16 | .16 |
| Monopole Oil.....lb. | .57 | .57 |
| Monten Wax.....lb. | .046 | .048 |
| Para Lube.....lb. | .15 | .22 |
| Paraffint RG and RGU Synthetic Wax.....lb. | .30 | .37 |
| Plaskon 8406, 8407.....lb. | .35 | .42 |
| 8416, 8417.....lb. | .40 | .47 |
| 8429.....lb. | .335 | .44 |
| Plurions.....lb. | .28 | .42 |
| Poly-Brite PE-200.....lb. | 1.20 | 1.40 |
| 600.....lb. | .93 | 1.06 |
| Poly-Cone 125X.....lb. | .29 | .42 |
| 1000.....lb. | 2.25 | 3.00 |
| Polyglycol E series.....gal. | .94 | .97 |
| RA-1, -2, -3.....lb. | 1.22 | 1.76 |
| Rubber Glo.....lb. | 1.35 | 1.45 |
| SM-33, -55, -61, -62.....lb. | .155 | .165 |
| Soap, Hawkeye.....lb. | .40 | .40 |
| Purity.....lb. | 1.20 | 1.25 |
| Sodium stearate.....gal. | 1.26 | 1.70 |
| 800 series.....gal. | 1.55 | 2.55 |
| 900 series.....gal. | 1.80 | 4.50 |
| A Series.....gal. | .12 | .375 |
| Ucon 50-HB Series.....lb. | .25 | .23 |
| Ulico.....gal. | 1.95 | 3.00 |
| Vanfre.....gal. | | |

Odorants

| | | |
|----------------------------|------|------|
| Alamasks.....lb. | .75 | 6.50 |
| Coumarin.....lb. | 2.95 | 3.55 |
| Curodex 19.....lb. | 4.75 | 5.05 |
| 188.....lb. | 5.75 | |
| 198.....lb. | 5.75 | |
| Ethavan.....lb. | 6.75 | 7.35 |
| Latex Perfume #7.....lb. | 4.00 | |
| Neutroleum Gamma.....lb. | 3.60 | |
| Roda.....lb. | 4.00 | 5.50 |
| Rubber Perfume #10.....lb. | 2.60 | |
| Vanillin, Monsanto.....lb. | 3.00 | 3.15 |

Plasticizers and Softeners

| | | |
|-------------------------------|-------|-------|
| Acintol R.....lb. | .065 | .07 |
| Adipol 2EH, 10A, XX.....lb. | .40 | .435 |
| BCA.....lb. | .43 | .455 |
| ODV.....lb. | .43 | .465 |
| Admex 710.....lb. | .325 | |
| 711.....lb. | .315 | |
| 744.....lb. | .40 | |
| Aro Lene #1980.....lb. | .10 | .12 |
| Baker AA Oil.....lb. | .195 | .24 |
| Crystal O Oil.....lb. | .21 | .255 |
| Processed oils.....lb. | .215 | .235 |
| Bardol, 639.....lb. | .215 | .235 |
| B.....lb. | .0625 | .065 |
| Benzoflex 2-45.....lb. | .26 | .29 |
| 9-38.....lb. | .27 | .30 |
| Bondogen.....lb. | .555 | .605 |
| BRC 20.....lb. | .15 | .175 |
| 22.....lb. | .025 | .0275 |
| 30.....lb. | .0125 | .021 |
| 521.....lb. | .019 | .02 |
| BRH 2.....lb. | .0213 | .0351 |
| BRS 700.....lb. | .02 | .0285 |
| BR7 7.....lb. | .03 | .031 |
| BRV.....lb. | .0475 | .0565 |
| Bunarex Liquid.....lb. | .0425 | .0555 |
| Resins.....lb. | .065 | .1225 |
| Bunnatol G, S.....lb. | .40 | .505 |
| Butac.....lb. | .125 | .135 |
| Butyl stearate, comml.....lb. | .255 | |
| Binney & Smith.....lb. | .23 | .26 |
| Hardesty.....lb. | .23 | .26 |
| Ohio-Apex.....lb. | .245 | .255 |
| Cabflex HS-10.....lb. | .4 | .42 |
| G. P.....lb. | .0125 | .02 |
| R-100.....lb. | .045 | .0525 |
| TT.....lb. | .017 | .02 |

| | | |
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| Califlux G. P.....lb. | \$0.015 | \$0.0225 |
| R-100.....lb. | .0475 | .0575 |
| T-T.....lb. | .019 | .0295 |
| 510, 550.....lb. | .0275 | .0375 |
| Capryl alcohol, comml.....lb. | .195 | .235 |
| Binney & Smith.....lb. | .18 | .28 |
| Harchem.....lb. | .18 | .28 |
| Chlorowax 40.....lb. | .1625 | .1825 |
| 70.....lb. | .185 | .245 |
| S.....lb. | .21 | .27 |
| Circo light.....gal. | .17 | |
| Cucosol-2XH.....gal. | .185 | |
| Contogums.....lb. | .0875 | .111 |
| Cumar Resins.....lb. | .065 | .17 |
| DBM (dibutyl-m-cresol).....lb. | | |
| Darax.....lb. | .32 | .3475 |
| DBP (dibutyl phthalate), comml.....lb. | .30 | .133 |
| Darex.....lb. | .30 | .33 |
| Eastman.....lb. | .29 | .335 |
| Harwick Std. Chem. Co.....lb. | .325 | .385 |
| Hatco.....lb. | .30 | .33 |
| Monsanto.....lb. | .30 | .33 |
| Naugatuck.....lb. | .30 | .33 |
| Ohio-Apex.....lb. | .30 | .335 |
| PX-104.....lb. | .30 | .33 |
| Rubber Corp. of America.....lb. | .30 | .44 |
| Sherwin-Williams.....lb. | .30 | .33 |
| DBS (dibutylsebacate).....lb. | .66 | .69 |
| Eastman.....lb. | .68 | .71 |
| Hatco.....lb. | .66 | .685 |
| Monoplex.....lb. | .66 | .675 |
| Naugatuck.....lb. | .665 | .69 |
| PX-404.....lb. | .665 | .69 |
| DCP (dicaprylphthalate), comml.....lb. | .295 | .325 |
| Hatco.....lb. | .295 | .325 |
| Monoplex.....lb. | .30 | .315 |
| DDA (didodecyladipate).....lb. | .425 | .455 |
| Cabflex.....lb. | .40 | .55 |
| Good-rite GP-236.....lb. | .305 | .335 |
| DDP (didodecylphthalate).....lb. | .295 | .45 |
| Cabflex.....lb. | .305 | .435 |
| Good-rite GP-266.....lb. | .355 | |
| Hatco.....lb. | | |
| Defoamer X-3.....lb. | | |
| DIBA (diisobutyladipate).....lb. | .4325 | .4625 |
| Cabflex.....lb. | .4325 | .4625 |
| Darex.....lb. | .41 | .44 |
| Eastman.....lb. | .41 | .445 |
| Ohio-Apex.....lb. | | |
| DIDA (diisododecyladipate).....lb. | .425 | .455 |
| Monsanto.....lb. | | |
| DIDP (diisododecylphthalate).....lb. | .32 | .35 |
| Darex.....lb. | .305 | .335 |
| Monsanto.....lb. | .29 | .325 |
| Ohio-Apex.....lb. | .305 | .335 |
| PX-120.....lb. | .06 | |
| Diex B.....lb. | .1525 | .1825 |
| Diethylene glycol, comml.....lb. | .15 | .165 |
| Wyandotte.....lb. | .285 | .32 |
| Dinopol IDO.....lb. | | |
| DIOA (diisooctyladipate).....lb. | .425 | .455 |
| Cabflex.....lb. | .435 | .465 |
| Naugatuck.....lb. | .425 | .455 |
| PX-208.....lb. | .425 | .56 |
| Rubber Corp. of America.....lb. | | |
| DIOF (diisooctylphthalate), comml.....lb. | .305 | .335 |
| Cabflex.....lb. | .305 | .335 |
| Darex.....lb. | .32 | .35 |
| Eastman.....lb. | .305 | .335 |
| Hatco.....lb. | .305 | .335 |
| Monsanto.....lb. | .305 | .335 |
| Naugatuck.....lb. | .305 | .335 |
| Ohio-Apex.....lb. | .28 | .315 |
| PX-108.....lb. | .305 | .335 |
| Rubber Corp. of America.....lb. | .305 | .45 |
| Sherwin-Williams.....lb. | .32 | .34 |
| DIOS (diisooctylsebacate), comml.....lb. | .61 | .64 |
| Rubber Corp. of America.....lb. | .61 | .84 |
| DIOZ (diisooctylazelaate).....lb. | .48 | .51 |
| Cabflex.....lb. | .33 | .38 |
| Dipolymer Oil.....gal. | .06 | .0625 |
| Dispersing Oil No. 10.....lb. | | |
| DNODP (di-n-octyl-n-decyl phthalate), Monsanto.....lb. | .345 | .375 |
| DOA (dioctyladipate), comml.....lb. | .425 | .455 |
| Cabflex.....lb. | .425 | .455 |
| Eastman.....lb. | .40 | .43 |
| Good-rite GP-233.....lb. | .40 | .55 |
| Hatco.....lb. | .435 | .465 |
| Monsanto.....lb. | .425 | .455 |
| Naugatuck.....lb. | .435 | .465 |
| PX-238.....lb. | .425 | .455 |
| Rubber Corp. of America.....lb. | .425 | .56 |
| DOP (dioctylphthalate), comml.....lb. | .305 | .335 |
| Cabflex.....lb. | .305 | .335 |
| Darex.....lb. | .32 | .35 |
| Eastman.....lb. | .28 | .315 |
| Good-rite GP-261.....lb. | .285 | .44 |
| Hatco.....lb. | .305 | .335 |
| Monsanto.....lb. | .305 | .335 |
| Naugatuck.....lb. | .305 | .335 |
| Ohio-Apex.....lb. | .28 | .315 |
| Polycizer 162.....lb. | .28 | .435 |
| PX-138.....lb. | .305 | .335 |
| Rubber Corp. of America.....lb. | .305 | .45 |
| Sherwin-Williams.....lb. | .305 | .335 |
| DOS (dioctylsebacate), comml.....lb. | .61 | .64 |
| Eastman.....lb. | .61 | .64 |
| Hatco.....lb. | .61 | .635 |
| Monoplex.....lb. | .61 | .635 |

| | | |
|--------------------------------------|---------|--------|
| Naugatuck.....lb. | \$0.615 | \$0.64 |
| PX-438.....lb. | .615 | .64 |
| Rubber Corp. of America.....lb. | .61 | .84 |
| Drapex 3.2.....lb. | .40 | .54 |
| Dutch Boy NL-A10 (DBP).....lb. | .30 | .33 |
| -A20 (DOP, A30 (DIOP).....lb. | .305 | .335 |
| -A54.....lb. | .295 | .325 |
| -C20 (DOS).....lb. | .305 | .425 |
| -F21.....lb. | .44 | .47 |
| -F41.....lb. | .48 | .51 |
| Dutrex 6.....lb. | .025 | .035 |
| Dymex Resin.....lb. | .135 | .1475 |
| Emulphor EL-719.....lb. | .52 | .73 |
| Endor.....lb. | .65 | |
| Ethox.....lb. | .43 | .455 |
| Ethylene glycol, comml.....lb. | .135 | .165 |
| Wyandotte.....lb. | .1325 | .1425 |
| Flexol 3 GH.....lb. | .44 | .55 |
| 3 GO.....lb. | .53 | .55 |
| 4 GO.....lb. | .325 | .355 |
| 426.....lb. | .425 | .455 |
| 810, 810X, 10-10, 10-10X.....lb. | .305 | .335 |
| TOF A-26.....lb. | .435 | .465 |
| Flexicin P-4.....lb. | .3475 | .3625 |
| P-6.....lb. | .415 | .43 |
| P-8.....lb. | .3475 | .3625 |
| PG-16.....lb. | .335 | .35 |
| Fortex.....lb. | .125 | .145 |
| G. B. Asphaltic Flux.....gal. | .097 | .177 |
| Naphthenic Neutrals.....gal. | .125 | .215 |
| Process oil, light.....lb. | .0275 | .0375 |
| Medium.....lb. | .0375 | .0475 |
| Galex W-100.....lb. | .155 | .18 |
| W-100 D.....lb. | .1525 | .1775 |
| Gilsox B.....lb. | .0975 | .11 |
| Harchemex.....lb. | .24 | .345 |
| Harflex.....lb. | 1.25 | 1.335 |
| 40.....lb. | .68 | .77 |
| 50.....lb. | .60 | .69 |
| 300.....lb. | .58 | .675 |
| 60.....lb. | .65 | .74 |
| 90.....lb. | .92 | 1.01 |
| 120, 150.....lb. | .28 | .375 |
| 40, 160.....lb. | .30 | .395 |
| 180.....lb. | .27 | .36 |
| 220, 250, 260.....lb. | .40 | .495 |
| 280.....lb. | .42 | .51 |
| 390.....lb. | .2525 | .3425 |
| 500.....lb. | .315 | .41 |
| HB-20.....lb. | .15 | .17 |
| -40.....lb. | .19 | .21 |
| Heavy Resin Oil.....lb. | .0225 | .0375 |
| HSC-13.....lb. | .25 | .32 |
| -39.....lb. | .22 | .29 |
| Hycar 1312.....lb. | .60 | |
| Indonex.....gal. | .13 | .225 |
| Kapsol.....lb. | .33 | .355 |
| Kenflex A, L.....lb. | .26 | .27 |
| N.....lb. | .23 | .24 |
| N.....lb. | .18 | .19 |
| Kesoflex 103.....lb. | .405 | |
| 105.....lb. | .3325 | |
| 106.....lb. | .38 | |
| 107.....lb. | .525 | |
| 110.....lb. | .24 | |
| 111.....lb. | .28 | |
| KP-23.....lb. | .315 | .325 |
| -90.....lb. | .40 | .435 |
| -140.....lb. | .46 | .485 |
| -201.....lb. | .58 | .59 |
| -220.....lb. | .33 | .365 |
| -555.....lb. | .59 | .60 |
| Kroniol.....lb. | .33 | .365 |
| Kronitol AA, I, K-3, Mx.....lb. | .325 | .36 |
| LX-685, -125, -135.....lb. | .125 | .135 |
| Marvinol plasticizers.....lb. | .28 | .8825 |
| Methox.....lb. | .385 | .41 |
| Monoplex S-38.....lb. | .215 | .24 |
| S-71.....lb. | .45 | .475 |
| Morflex.....lb. | .25 | .65 |
| Natac.....lb. | .12 | .13 |
| Neoprene Peptizer P-12.....lb. | 1.05 | |
| Nevillac.....lb. | .31 | .85 |
| Neville R Resins.....lb. | .145 | .205 |
| Nevind.....lb. | .24 | |
| No. 1-D heavy oil.....lb. | .065 | |
| NP-10.....lb. | .50 | .53 |
| ODA (octyldecyladipate).....lb. | .425 | .455 |
| Good-rite GP-235.....lb. | .40 | .55 |
| ODP (octyldecylphthalate).....lb. | | |
| Cabflex.....lb. | .305 | .335 |
| Good-rite GP-265.....lb. | .29 | .445 |
| Hatco.....lb. | .305 | .335 |
| Rubber Corp. of America.....lb. | .305 | .45 |
| Ohopex Q-10.....lb. | .28 | .315 |
| R-9.....lb. | .3525 | .3775 |
| Orthonitr benzophenol, comml.....lb. | .13 | .15 |
| Monsanto.....lb. | .13 | .15 |
| Palmalene.....lb. | .15 | |
| Paraflex BN-1.....lb. | .85 | .225 |
| Paraflex Resins.....lb. | .09 | .185 |
| Para Flux, regular.....gal. | .10 | .2125 |
| No. 2016.....gal. | .165 | .24 |
| 2332.....gal. | .11 | |
| 4205.....lb. | .1075 | .2125 |
| Para Lube.....lb. | .046 | .048 |
| Resins.....lb. | .04 | .045 |
| Paradene Resins.....lb. | .07 | .08 |
| Paraplex 5-B.....lb. | .29 | .3475 |
| Al-111.....lb. | .32 | .3275 |
| G-25.....lb. | .76 | .77 |
| -40.....lb. | .4825 | .51 |
| -53.....lb. | .39 | .4175 |
| -60.....lb. | .4325 | .46 |
| -62.....lb. | .325 | .35 |
| | .345 | .37 |

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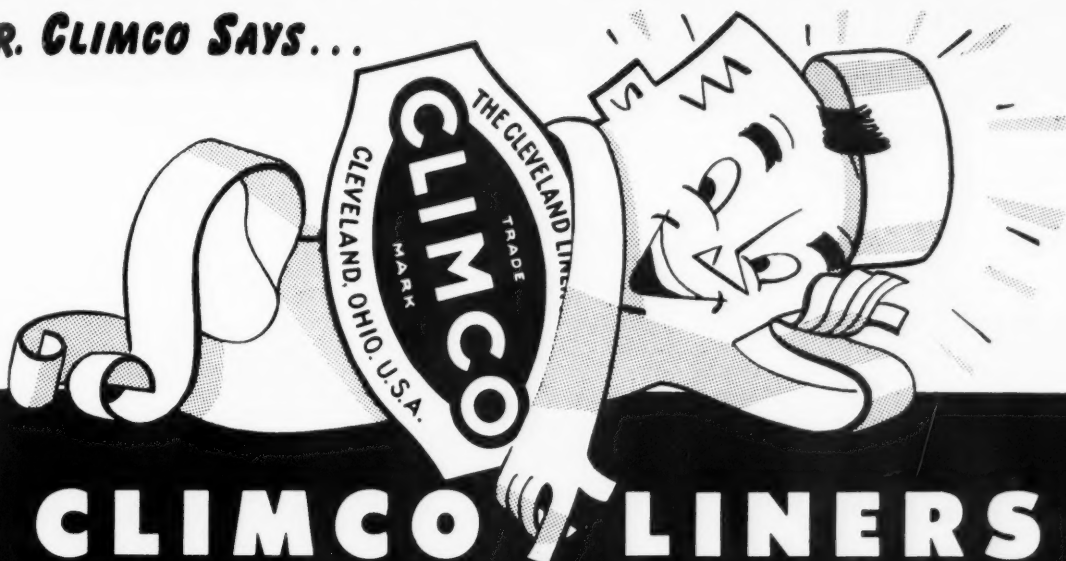
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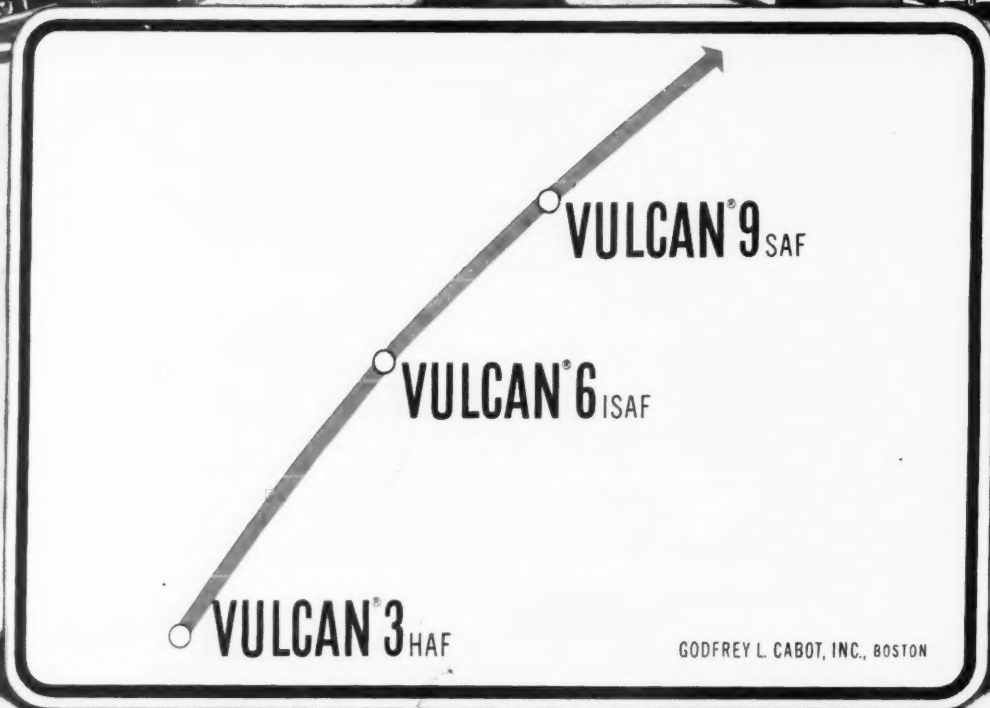
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